

IPCC's Third Assessment Report

Too Much 'Imagination Block'

by Bob Foster

**being the third supplementary submission to the
Joint Standing Committee on Treaties Inquiry
into The Kyoto Protocol by RJ Foster**

April 2001

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ABSTRACT

The Third Assessment Report of Working Group 1 of the Intergovernmental Panel on Climate Change, entitled 'Climate change 2001: the scientific basis', builds on past assessments plus the last five years of research into climate change. The draft of its *Summary for Policymakers* was approved and released at Shanghai on 21 January 2001. The 'Shanghai Draft' is advocacy masquerading as science; 'imagination block' rules.

* The *Summary for Policymakers* of IPCC's previous (*i.e.*, Second) Assessment Report, released in 1996, included the spurious claim that 'the balance of evidence suggests a discernible human influence on global climate', and the new *Summary* repeats it. This self-serving but highly-influential claim was founded on a purported warming trend observed in the lower atmosphere of the Southern Hemisphere. The non-existent 'trend' is an artefact of the unrepresentative run of years selected for study.

* The new *Summary for Policymakers* acknowledges the crucial fact that for the last '20 years' (actually 24, since a prominent jump at 1976/77) there has been much less warming in the lower atmosphere than at the surface; however, it obfuscates the conclusion to be drawn from this compelling evidence: Human-caused greenhouse gas emissions (principally CO₂) don't warm the surface directly, *i.e.*, greenhouse is a phenomenon of the atmosphere; thus, without prior warming of the lower atmosphere, there is no resultant 'greenhouse effect' warming at the surface.

* The *Summary* fails to warn us that, although GHG emissions have continued unabated since 1977, most of the observed surface warming since that time results from some other cause than greenhouse—because there has been little atmospheric warming.

* IPCC's *Summary for Policymakers* claims that 'most of the warming observed over the last 50 years is attributable to human activities'. However, except for the jump at 1976/77, there has been no substantial warming of the lower atmosphere since adequate observations began in 1958. Furthermore, and not mentioned in the *Summary*, the step-change at 1976/77 is associated with a

¹ Robert J Foster is a consultant in energy economics at 30A Vautier St Elwood, VIC 3184 Australia, phone (61) (3) 9525 6335 and fax 6345. He is an Adelaide University engineer by qualification, a Shell geoscientist by experience, was latterly GM Marketing at BHP Petroleum, and is now Hon Treasurer of the Royal Society of Victoria. Bob is an Honorary Fellow in the School of Ecology and Environment at Deakin University, and also Victorian representative on the Environment Committee of the Australian Institute of Company Directors. He is a founding director of The Lavoisier Group Inc, which is putting to Australians a view on climate-change countervailing to that of the Intergovernmental Panel on Climate Change (IPCC).

major re-ordering of oceanic heat transportation at that time. The warming during ‘the last 50 years’, in fact, refers to a slight cooling from 1945 to 1976 and a more-pronounced warming thereafter. The most prominent climate-related feature of the 20th century is a sudden nonlinear transition between climatic regimes at 1976/77. This dramatic event stems from an abrupt, and probably inertially-related, reduction in the upwelling of cold, deep water in the Pacific at that time—of which there is abundant evidence in the peer-reviewed scientific literature.

* IPCC presents its ‘greenhouse effect’ hypothesis of global climate change as though it were the only plausible explanation for 50 year’s observations. It fails to mention the, at least equally (and in my opinion much more) plausible, ocean-related alternative which is here termed the ‘oceanic impedance’ hypothesis of global climate change.

* The *Summary* increases the upper limit of the projected range of globally-averaged warming outcomes at the surface (from 3.5⁰C in the 1996 Report) to 5.8⁰C in 2100. (This new upper limit received much publicity when leaked during the US presidential election campaign.) Most of the increase in IPCC’s warming prediction is derived from the expectation of more success than previously assumed in curtailing the emission of (cooling) sulphate aerosols from the combustion of fossil fuels (less offset by cooling means more net warming). However, a global coverage of temperatures in the lower atmosphere since 1979 reveals that the Southern Hemisphere has cooled since then—despite 90% of the ‘cooling’ aerosols having been released in the Northern Hemisphere, which is warming. In real-life, it appears that aerosol cooling is negligible, and hence IPCC’s reliance on reduced aerosol cooling in future, as justification its prediction of increased net warming, is unwarranted. When other factors are also taken into account, an upper bound for the range of plausible warming expectations falls below 2.5⁰C.

* IPCC allows ‘Policymakers’ to believe that if we ‘do the right thing’ about anthropogenic GHG emissions, we can stabilise climate. The cyclic nature of global climate, rebound from the Little Ice Age (AD 1300–1900) as a factor in 20th century warming, and the inevitability of future natural climate changes, are all ignored. The *Summary* asserts that warming during the 20th century is unusual in the context of past natural climate changes. This spurious conclusion results from comparing 900 year’s proxy data, mostly from tree rings at high latitudes and high altitudes in the Northern Hemisphere, with a 100 year’s measured temperatures. But these trees only grow in growing season—4/6 weeks in early summer—and warming at high latitudes is largely in winter. IPCC mistakenly makes an apples-and-oranges comparison here. When tree rings are studied for the entire 1000 years, the last 100 years no longer look ‘unusual’.

Readers beware! Believe IPCC’s new ‘Shanghai Draft’ *Summary* at your peril.

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1. IPCC'S CLIMATE-CHANGE ASSESSMENT REPORTS

1.1 Second Assessment Report of Working Group I

The Intergovernmental Panel on Climate Change is a joint project of the United Nations Environment Program and the World Meteorological Organisation; and IPCC's Second Assessment Report (SAR), released in 1996, was the intellectual underpinning of the Kyoto Conference in 1997. IPCC's Working Group 1, covering the science, was responsible for the first volume of this 3-volume work.

The Report of WG1, *Climate Change 1995: the science of climate change* (Houghton *et al.*, eds 1996) was a substantial technical document. My first supplementary submission to JSCOT, *The Kyoto Protocol: don't forget the science* of 15 November 2000, confined its analysis to the Report's first 50 pages comprising *Preface*, *Summary for Policymakers* and *Technical Summary*, because Australia's 'policymakers', neither politicians nor public servants, would have time to read the whole 572 pages.

My submission (RJF #1, 80 pages and 77 figures) disagrees with the fundamental thesis of the IPCC Report, and its 'consensus of 2,500 of the world's top climate scientists' that the warming trend at the Earth's surface during the 20th century was largely the result of anthropogenic changes to the composition of the atmosphere; and with the implication that if we 'do the right thing' about future use of fossil fuels, we can stabilise our climate.

Since then I have made a second supplementary submission to JSCOT, *Climate-change science: duel of the hypotheses* of 31 December 2000. In this submission (RJF #2, 61 p 27 figs), I contrast IPCC's '**Greenhouse Effect**' hypothesis of global climate change (the dominant paradigm in climate-change science) with a more-plausible alternative which I call the '**Oceanic Impedance**' hypothesis.

The two competing paradigms—atmospheric and oceanic—are incommensurable.

1.2 WG1 Third Assessment Report: the 'Shanghai Draft'

The contribution of Working Group 1 to IPCC's yet-to-be-released Third Assessment Report (TAR), entitled *Climate Change 2001: The Scientific Basis*, is said to contain some 1,000 pages. This new Report on the science of climate-change is the culmination of work by the 'many hundreds of scientists from many countries' who participated in its preparation and review.

A draft of the *Summary for Policymakers* of the new WG1 Report was approved and released in Shanghai on 21/1/2001. It is marked 'NOT FINAL, CHECKING AND EDITING STILL REQUIRED'. A critical review of the 'Shanghai Draft' forms the basis of this, my third, supplementary submission to JSCOT.

In the interests of brevity, I have not here repeated all the relevant supporting material and references contained in my previous more-extensive submissions (RJF #1 and 2).

2. HOW INCOMMENSURABLE PARADIGMS COMPETE

When I was at Adelaide University in the 1950's, the paradigm of Lyellian uniformitarianism which had dominated the earth sciences for a century, was facing mounting pressure from Wegener's more-plausible continental drift hypothesis. Wegener was a German meteorologist and explorer; and his hypothesis was first published in 1912; he drew his conclusions from observational and deductive science, including two obvious and well known correlations:

- the good fit between continental margins on opposite sides of the Atlantic; and
- a similarity of Australia's endemic species to those of South America but not SE Asia.

With few exceptions,² the world's geologists fought like tigers to prevent the acceptance of the new paradigm, and thus preserve the intellectual capital built up over their working lives. Their main defence was that no known mechanism could have propelled the supposed continental movement, and hence the apparent fit in the Atlantic Basin must be coincidence. The USGS, a senior custodian of the dominant paradigm, was among those promoting the bizarre concept of intermittent land bridges, of which no trace now remained, to explain the observed distribution of plants and animals.

Canberra geologist Cliff Ollier says³ that, in 1950, Walter Bucher wrote in *Scientific American*:

In short, everything that is known concerning the configuration and structure of the floors of the oceans proves conclusively that Wegener's hypothesis of continental drift is wholly untenable.

Ollier again tells us that:

R.T. Chamberlin said geologists might well ask if theirs could still be regarded as a science, when it is 'possible for a theory such as this to run wild'. Baily Willis wrote ... 'the hypothesis should, in my judgement, be placed in the discard, since further discussion of it merely incumbers the literature and befogs the minds of fellow scientists'.

But my favourite is:

Sir Harold Jeffreys disposed of continental drift as ... 'an explanation which explains nothing which we wish to explain'.

Uniformitarianism was finally discredited in the 60s by advances in geophysics, particularly by new palaeomagnetic data. Plate tectonics, entailing sea-floor spreading and subduction of one plate-margin beneath another, became the new dominant paradigm.

Back in 1958, we students believed in Wegener, but might have been failed for saying so; one forgets the *vehemence* of those days. I learned three things about science at that time:

2 Professor Sam Carey from the University of Tasmania submitted to the American Geophysical Union in 1953 what was probably the first paper including a model for the subduction process. Publication was rejected.

3 In *Geology Today* (July-August 1985, p 99) and reprinted in *The Australian Geologist* in 1996.

- It is unwise to deny tangible data just because we do not yet know why things are so;
 - A dominant paradigm is not withdrawn by its custodians, but overthrown from outside;
- and, the most important of all
- The advancement of science is not a matter of voting.

3. QUESTIONS ABOUT 20TH CENTURY CLIMATE

3.1 A serious case of ‘imagination block’

The most striking natural occurrence of the 20th century was at 1976/77. It took the form of a step-change to a warmer climate; and, good or bad, we live it now. This remarkable event is *ocean-related*, whereas greenhouse is a phenomenon of the *atmosphere*.

But what does IPCC’s Shanghai Draft say about this abrupt non-linear transition between climatic regimes?

I promise I am telling the truth here: the Draft gives no hint that something very relevant indeed is happening out there in real-life, which has little or nothing to do with the ‘greenhouse effect’. IPCC is suffering from a serious case of ‘imagination block’.⁴

One would not know it from a cursory reading of the Shanghai Draft, but IPCC and its ‘**Greenhouse Effect**’ hypothesis of global climate change is under siege from the facts. However, if I am to go beyond assertion here, some fundamental questions must first be addressed.

3.2 What is the ‘Greenhouse Effect’?

Greenhouse gas emissions from human activities (mostly CO₂ from the burning of fossil fuels) cause more of the heat escaping from the Earth’s surface to be trapped in the atmosphere, and this extra warmth is redistributed, in its turn, upward to Space or back to the surface. It is the *resultant* surface warming which we call the ‘greenhouse effect’. GHGs don’t warm the surface directly. Thus, no prior warming of the lower atmosphere means no greenhouse warming attributable to it (see RJF #1, Section 5 and Figs 45–53).

3.3 What is happening in the atmosphere?

A 22-year-long global coverage of temperature in the lower atmosphere, derived from microwave sounding units mounted on polar-orbiting weather satellites, reveals modest warming in the Northern Hemisphere, but slight cooling in the Southern (**Figure 1a**). Globally-averaged, it shows an atmospheric warming trend of only about 0.05⁰C/decade (**Figure 1b**)—low enough that if the influence of the prominent El Niño warm event in 1998 were to be ignored, the atmosphere would display a cooling trend.

Furthermore, a less-complete coverage of temperatures in the lower atmosphere from balloon-borne thermometers is available back as far as 1958. Although this longer record is largely over land, and sparse at high latitudes, it agrees well with the satellites for their 22-year period of overlap. If a

4 David Fisk, Chief Scientist of the UK Department of the Environment in ‘Sound science and the environment’ (*Science and Public Affairs*, Spring 1997 pp 46-9) says under the heading ‘Imagination block’ that ‘One of the most difficult areas in an assessment is to be sure that all the possible interpretations of the data have been explored’.

prominent warming step of some 0.3°C at 1976/77 (of which much more later) is excluded, balloons show no significant trend in atmospheric temperature for their 43-year period of coverage.

3.4 What is happening at the surface?

Warming of near-surface air in the 20th century was in two roughly-equal tranches totalling some 0.6°C. The first was 1910–45, followed by 3 decades of slight cooling, with renewed warming at 1976–2000 (see **Figure 2** from John Daly’s contrarian website, but originally from NASA’s Goddard Institute of Space Studies).

A significant difference between near-surface and lower-atmosphere temperature trends is apparent during the two decades for which global satellite coverage is available. Warming in the lower atmosphere is about 0.05°C, compared to some 0.13–0.19°C/decade—*i.e.*, *three times as much*—at the surface over a similar period. This remarkable (and I say, crucial) atmosphere/surface discrepancy is illustrated in **Figure 3**

3.5 A little palaeoclimatology

A little climate-history is needed to complete the picture. We live in an Ice Age of long Glacials and short Interglacials on a 100,000-year cycle; and it is our good fortune to have enjoyed the latter for the last 10,000 years. This benign period is called the Holocene.

Even in the Holocene, the longer cycle is overprinted by a variable warm/cold cyclicity of *ca* 1500-years period centred on the North Atlantic Basin. The Mediaeval Warm Period (AD 800–1200) and Little Ice Age (AD 1300–1900) are its latest manifestations (see **Figure 4**). European written records tell us that the LIA was a time of intense, albeit intermittent, cold and misery. In East Africa, by way of contrast, it was the twin troughs of the coldest episode which offered the greatest prosperity (**Figure 5**); although oral records don’t extend so far back, lake records suggest the MWP was very dry indeed.

The 100,000-year global climate cycle, and less-pronounced cyclicities of 40,000 and 20,000 years appear to be orbitally-driven, although with the relatively-modest insolation changes boosted by earthly feedbacks. On the other hand, the over-printed 1,500-year and 65-year cycles (which are most prominent in the Northern Hemisphere) are more likely to be inertially-related.

This series of nested climate cycles is completed by El Niño warm events, centred in the equatorial Eastern Pacific with an irregular frequency of less than a decade; the graphs in Figure 1 record a particularly strong El Niño peaking in early 1998.

In my opinion, someone who believes that by ‘doing the right thing’ about fossil fuel consumption we can stabilise climate, will believe anything.

Although not discussed in this submission, the same applies to sea level. At the Last Glacial Maximum, 20,000 years ago, sea level was some 120–135 metres lower than today. Behaviour of the West Antarctic Ice Sheet could be crucial. More information on ice-sheet surging and its implications is provided in Foster (1999), and my JSCOT submission RJF #2.

4. EXPLAINING THE 20th CENTURY SURFACE RECORD

4.1 First tranche of warming, 1910–45

Returning now to the surface record (as displayed in Figure 2), the earlier tranche of warming predates the main build-up of human-caused GHGs in the atmosphere.

Although the evidence is not conclusive (because we have no knowledge of atmospheric temperatures so far back), rebound from the Little Ice Age—in the form of increased solar activity and increased flow of equatorial water into the Nordic seas (plus the ever-present feedbacks)—provides a more-plausible explanation than does greenhouse.

4.2 Second tranche of warming, 1976–2000

But for the second tranche of surface warming from 1976 onward, the conclusion is inescapable: this is not ‘greenhouse effect’ warming.

Instead, it stems from a sudden nonlinear transition between climatic regimes at 1976/77. This extensively-documented event is ocean-related, as will be demonstrated below (much more information is provided in RJF #2). However, its ultimate cause is less clear. It is probably inertially-driven, as suggested by the correlation between changes in climate (**Figure 6a**) and length of day variations as shown in **Figure 6b**. Possible drivers include the surging of (Antarctic or Greenland) ice into the sea, or lunar tidal influences. There could also be elements here of hunting/resonance persisting from the time of earlier and larger inertial influences.

In more-pronounced changes at longer time-scales, such as the 1500-year pacing of North Atlantic Basin climate over many tens of thousands of years, the available records strongly implicate ice surges (see RJF #2, Figure 25).

It is on the basis of the palaeoclimate analogue that I call the alternative to IPCC’s ‘Greenhouse Effect’ hypothesis (*i.e.*, to the dominant paradigm) the ‘*Oceanic Impedance*’ hypothesis of global climate change. Inertial changes impede the transportation of oceanic heat, particularly in the geometrically-complex Atlantic Basin, and one outcome is variations in the rate of upwelling of cold, deep water in the eastern Pacific.

Between the upwelling seasons of 1976 and 1977, the quantity of cold, deep water reaching the surface in the equatorial and NE Pacific fell sharply and has not yet recovered. Although upwelling appears to have strengthened concurrently in the subtropical South Pacific, leading to regional cooling over the succeeding decade it was not sufficient to compensate globally for the warming further north.

Direct evidence of the 1976/77 change is provided by a detailed instrumental record of sea surface temperatures in the equatorial eastern Pacific (**Figure 7**).

Here, it can be seen that warm season SSTs are relatively stable except in El Niño (warm event) years. However, when La Niña (cool event) years are excluded, there is a sharp change in cold season SSTs visible at 76/77. This step-change is undoubtedly caused by a reduction in upwelling, which has not yet reversed.

A similar, areally more-extensive but less-detailed, record of SSTs in the equatorial eastern Pacific is given in the bottom graph of **Figure 8**. The upper graph in the Figure shows the oxygen-isotope record (a proxy for temperature and/or salinity changes) for corals in the equatorial central Pacific. The centre graph shows the ENSO index, which changed in the direction of more frequent El Niño (warm) events at the same time as changes in the warmer direction in the other two records. There was a prominent change in equatorial Pacific climate at 76/77.

There were two immediate outcomes. The heat content of the upper layers of the world's oceans increased (**Figure 9a**); and average temperature in the lower atmosphere (trendless before and after) also took an upward step, doubtless in response to the warmer ocean surface (**Figure 9b**).

These changes have ramifications around the world. For instance, a sharp increase in winter wave intensity on the coast of NW Europe (**Figure 10a**) also coincides with the step in atmospheric temperature (**Figure 10b**). Fish catches in the eastern Pacific (**Figure 11a**) show two peaks in the 20th century at about 1920–45 and from 1980 onward⁵ which are closely coincident with periods of reduced upwelling in the NE Pacific (**Figure 11b**). There is a similar timing to changes in rainfall trends in eastern China (**Figure 12**). Those of you who have spent time in Beijing will have found that winter climate is dominated by the very cold and very dry Siberian high—cloudless skies, bitter cold and dusty streets. Eastern China is crucially dependent on summer rainfall. The top graph of the figure shows a clear change in trend in the mid-1970s—yet another pointer to a major change in climatic regime at this time.

A growing body of evidence points to a major re-ordering of oceanic circulation in 1976/77, of which a sharp reduction in the upwelling of cold, deep water in the equatorial and NE Pacific is an important part. This evidence supports the 'Oceanic Impedance', but not the 'Greenhouse Effect', hypothesis of global climate change.

Remember, no warming trend in the lower atmosphere means no consequent 'greenhouse effect' warming at the surface. We know there is no warming trend in the atmosphere since records began in 1958—a period of 43 years—if the upward step of about 0.3⁰C at 1976/77 is excluded. I show above that this step is a reflection of a major re-ordering of oceanic circulation at that time, and is unrelated to human-caused changes in the composition of the atmosphere.

5 There are current anthropogenic pressures on replenishment of stocks in Pacific salmon species because of the supplanting of coal and nuclear power generation on the US West coast by 'greener' hydropower.

5. ADVANCES IN SCIENTIFIC UNDERSTANDING

This section reviews relevant papers in the scientific literature which are too recent to have been discussed in my previous submissions to JSCOT, or indeed to have been used in preparation of IPCC's Shanghai Draft.

Nevertheless, they are too important to ignore.

5 1 Why is the atmosphere not warming?

As can be seen in the record of temperature for the lower atmosphere (available back to 1958, see Figures 9b and 10b), the abrupt reduction in the upwelling of cold water in the eastern Pacific at 1976/77 and the concurrent rise in sea-surface temperature caused a consequent step-change in atmospheric temperature.

As is shown in monthly detail in Figure 1a, an even deeper (but transient) reduction in upwelling during the prominent 1998 El Niño event was also quickly reflected in global atmospheric temperature. This is as expected, because the tropical Pacific sea-surface is such a powerful source of heat, and covers such a large proportionate area of the Globe.

Obviously, the atmosphere *is* responsive to changes at the sea-surface.

But why has the continued warmth of the Pacific sea-surface from 1976 (as shown in Figure 8) not been accompanied by a rising trend in temperature of the lower atmosphere—irrespective of any greenhouse considerations—over the past quarter-century?

A plausible explanation is now available. In his evidence to JSCOT's Canberra hearing of 3/11/2000, Richard S Lindzen mentioned a study of cloud variation above the western Pacific in the Japan/Australia/Hawaii region, as observed by a Japanese geostationary satellite. He described a newly-recognised, and cloud-related, 'iris effect' which allows more heat to escape to Space when the sea-surface is hotter.

On 28/2/2001 NASA's Goddard Space Flight Centre issued a press release entitled "Natural 'heat vent' in Pacific cloud cover could diminish greenhouse warming", foreshadowing publication of a paper in the March issue of the Bulletin of the American Meteorological Society. The authors are Goddard's Arthur Y Hou and Ming-Dah Chou, plus MIT's Lindzen as senior author (Lindzen, Chou and Hou 2001).

The NASA release says, in part:

The tropical Pacific Ocean may be able to open a 'vent' in its heat-trapping cirrus cloud cover and release enough energy into space to significantly diminish the projected climate warming caused by a buildup of greenhouse gases in the atmosphere.

and

‘High clouds over the western tropical Pacific Ocean seem to systematically decrease when sea surface temperatures are higher’, says Arthur Y Hou. ... The ‘adaptive infrared iris’ of cirrus clouds opens and closes to permit the release of infrared energy, thus resisting warmer tropical sea surface temperatures, which occur naturally and are predicted to increase as the result of climate warming.

The release concludes:

Clouds play a critical and complicated role in regulating the temperature of the Earth. Thick, bright, watery clouds like cumulus shield the atmosphere from incoming solar radiation by reflecting much of it back into space. Thin, icy cirrus clouds are poor sunshields but very efficient insulators that trap energy rising from the Earth’s warmed surface. A decrease in cirrus cloud area would have a cooling effect by allowing more heat energy, or infrared radiation, to leave the planet.

and finally, of much potential relevance

If this ‘iris effect’ is found to be a general process active in tropical oceans around the world, the Earth may be much less sensitive to the warming effects of such influences as rising greenhouse gas concentrations in the atmosphere. The researchers estimate that this effect could cut by two-thirds the projected increase in global temperatures initiated by a doubling of carbon dioxide in the atmosphere.

Once this work is confirmed by a longer run of data (only 20 months were included in the study), as well as by a more-comprehensive coverage of the tropical oceans, it will have demonstrated the existence of a natural thermostat—and an antidote to the ‘greenhouse effect’. This would be a breakthrough indeed for climate-change science.

5.2. How relevant is sea surface temperature?

IPCC’s instrumented record of global mean near-surface temperature for the past 140 years is shown in Figure 6a.

There are problems with this record. First, coverage is sparse to the north of 70⁰N, and to the south of 50⁰S. Second, direct measurements of near-surface air (at an altitude of a metre or two) are only available for the one-third of the Globe which is land. Even here, creeping urbanisation is changing the micro-climate at many meteorological stations; and furthermore, stations that remain isolated from urban development are often subject to the impact of changes in rural land-use. Poorly kept or discontinuous records are a further concern. These issues already have been widely discussed.

Up until now, shipboard measurements of near-surface (say, at a depth of up to 15 metres) water temperature have been accepted as an adequate proxy for near-surface air for the two-thirds of the Globe which is sea. It is this proxy which has contributed to the record in Figure 6a.

A new paper (Christy *et al.*, 2001) includes a plot of several derivations of air temperature minus, in each case, sea-surface temperature (**Figure 13**) for the 20⁰S to 20⁰N band of tropical seas. All subtractions reveal a negative trend, *i.e.*, since 1979, at least, SST is increasing faster than that of the overlying atmosphere.

Three of the plots give very similar results. These use, respectively, satellite-derived temperatures for the low-mid troposphere, a (rather sparse) coverage of balloon-derived temperatures which agrees well with the satellites, and a model-derived record for the lower atmosphere which uses all available measurements as input.

Those reading my two earlier submissions will not be surprised to learn that the lower atmosphere (low-mid troposphere) has not warmed as fast as the adjacent sea surface.

But it is the fourth subtraction made by Christy *et al.* which is the most revealing. Near-surface air temperature data is already available from measurements taken on the decks of ships, but is too poorly-controlled to be of much use. However, more-consistent information is now available from weather buoys which have been moored in the tropical eastern Pacific since the early 1980s. The buoys record at 1 metre depth for SST, and at 3 metres height for air temperature.

The plot of night marine air temperature (at night, to avoid an instrumental bias caused by the Sun) minus SST also shows a negative trend, *i.e.*, near-surface air over the tropical Pacific is not warming as fast as is the underlying sea-surface.

Obviously, NMAT does not differ from SST by as much as does temperature in the lower troposphere, as shown in Figure 13. However, even this lesser difference has big implications. Christy *et al.* conclude:

Our global blend of NMAT and (all hours) near-surface land air temperatures indicates a global trend of + 0.13 K decade⁻¹ for 1979-1999, slightly less positive than the more utilized SST-based dataset which reports a temperature trend of + 0.18 K decade⁻¹.

The extent of actual near-surface warming during the 20th century is still a matter of conjecture; but it is more likely to be presently over-estimated than the reverse.

5.3 Warming vs cooling by anthropogenic emissions

In Sections 5.2 and 5.3 of RJF #2, I describe IPCC's invocation of cooling anthropogenic aerosols to reconcile its overwarming models with an underwarming 20th century world. If there were no counterbalance from aerosol cooling, it would be necessary to conclude that IPCC has included in its models too great a sensitivity to GHG warming.

I point out that (see RJF #2, Figure 14) some 90% of these short-lived, and mostly fossil-fuel-derived, aerosols are emitted in the Northern Hemisphere and, therefore, the cooling effect should be much more pronounced in that hemisphere.

However, in real-life, it is the Southern Hemisphere which is cooling (compare the two graphs in Figure 1a of the present submission). Thus the law of empirical disproof has exposed the assumption of aerosol cooling as wrong, and hence has negated IPCC's reconciliation of 20th century reality with hindcasts of its climate models.

An explanation is now to hand for the observed lack of aerosol cooling. Jacobsen (2001) finds a higher positive forcing (*i.e.*, more warming) from black carbon in the aerosols released by the burning of fossil fuel and biomass than previously thought. He suggests, therefore, that ‘the warming effect from black carbon may nearly balance the net cooling effect of other anthropogenic aerosol cooling constituents’. This finding has important implications for the veracity of IPCC’s model-based predictions of 21st century warming (as will be discussed below).

5.4 Little Ice Age, Mediaeval Warm Period, and Holocene cyclicality

In the area of Holocene climate cyclicality in general, and rebound from the Little Ice Age in particular, imagination block has a distinguished history.

In 1988, CSIRO and the Commission for the Future combined to bring ‘young outspoken climatologist’ Stephen Schneider to Australia. The centre-piece of his trip was the ‘Greenhouse Action 88’ event in Melbourne on 3 November, relayed on closed-circuit TV to other states. (I was one of four Australians invited to be supporting speakers.)

Schneider had already retracted his prediction that world sea level would rise by 5 metres in the next 150 years, but still claimed that the atmosphere would warm as much in the next 50 years as it had in the past 15,000. He reviewed 20th century surface warming (referring to evidence from the Northern Hemisphere) without revealing to his lay audience the prior existence of the Little Ice Age. I was converted that very evening from booster to sceptic.

When IPCC released its Second Assessment Report, the WG1 report on the science of climate change (Houghton *et al.*, 1996) made no mention of the Little Ice Age in the summaries which comprised its first 50 pages. Neither was there mention that rebound from it might well explain a significant proportion of observed 20th century warming.

This surprising omission caused me to collate the abundant evidence available from the geosciences pointing to natural climate cyclicality at relevant time-scales (Foster 1999). This paper became the basis for my first supplementary submission to JSCOT (RJF #1).

A *Perspectives* article on palaeoclimatology in *Science* of 23 February (Broecker 2001) reviews the current state of the evidence. Even now, imagination block rules (as will be discussed below in the context of the Shanghai Draft); and Broecker introduces his theme with some pointed and timely observations:

A recent, widely cited reconstruction⁶ leaves the impression that the 20th century warming was unique during the last millennium. It shows no hint of the Medieval Warm Period (from around 800 to 1200 A.D.) during which the Vikings colonized Greenland, suggesting that this warm event was regional rather than global. It also remains unclear why just at the dawn of the Industrial Revolution and before the emission of substantial amounts of anthropogenic greenhouse gases, Earth’s temperature began to rise steeply.

6 Criticised in RJF #1 Section 6.3 ‘Mann and the millennium hockey-stick’ (pp 61-70 and Figures 62-7).

Was it coincidence? I do not think so. I suspect that the post-1860 natural warming was the most recent in a series of similar warmings spaced at roughly 1500-year intervals throughout the present interglacial, the Holocene. Bond et al (1999) have argued, on the basis of the ratio of iron-stained to clean grains in ice-rafted debris in North Atlantic sediments, that climatic conditions have oscillated steadily over the past 100,000 years, with an average period close to 1500 years. They also find evidence for the Little Ice Age (from about 1300 to 1860). I agree with the authors that the swing from the Medieval Warm Period to the Little Ice Age was the penultimate of these oscillations ...

Figure 14 shows the proxy which ice-rafted debris in the North Atlantic provides for a cyclic Holocene climate. The boxes at the top of the graph indicate observed periods of retreat for mountain glaciers. Broecker concludes his review by saying:

The geographic pattern of Holocene climate fluctuations remains murky, but several things are clear. The Little Ice Age and the subsequent warming were global in extent. Several Holocene fluctuations in snow-line, comparable in magnitude to that of the post-Little Ice Age warming, occurred in the Swiss Alps. Borehole records both in polar ice and in wells from all continents suggest the existence of a Medieval Warm Period. Finally, two multidecade-duration droughts plagued the western United States during the latter part of the Medieval Warm Period. I consider this evidence sufficiently convincing to merit an intensification of studies aimed at elucidating Holocene climate fluctuations, upon which the warming due to greenhouse gases is superimposed.

A *News Focus* report⁷ of 2 March shows how entrenched is the idea of human-caused warming as the sole explanation for melting in mountain glaciers. A study finds that Kenya's Kilimanjaro has lost 82% of its ice since 1912 and 33% since 1989. Will Steffen, director of the International Geosphere-Biosphere Program, Stockholm, says:

This is exceptionally important work. Tropical glaciers are a bellwether of human influence on the earth system.

But, as Figure 5 shows, there is much more to East African climate than human influence.

5.5 Present-day surging of the West Antarctic Ice Sheet

Under the headline 'Alarm bells sound over shrinking glacier' and the subheading 'scientists show for the first time that Antarctic ice is melting', *The Age of Melbourne* reports surging of the Pine Island Glacier⁸—in an article by Tim Radford reprinted from the *Guardian*, an enthusiastic bearer of bad tidings on things environmental.

The press report begins:

For the first time, scientists have detected ominous signs of the ice thinning in west Antarctica.

7 'Globe-girdling science in the Golden gate city', *Science* v 291 pp 1689-91, reporting the annual meeting of the American Association for the Advancement of Science.

8 Surging of West Antarctic glaciers and the implications of a possible collapse of the WAIS are discussed in RJF #2 Section 8.5 'Modern-day surging of the West Antarctic ice-sheet' (pp 52, 3 and Figure 27).

The continent's biggest glacier, which has been systematically measured for the last eight years, has lost a 10-metre thickness of ice and retreated five kilometres inland.

If the thinning continues at that rate, the entire glacier could disappear into the ocean within a few hundred years.

There have been fears for more than a decade that the west Antarctic ice sheet could be unstable.

The region holds enough ice to raise sea levels by five metres; flooding coastal cities such as London, New York, Tokyo and Calcutta.

What has caused our impending doom? The article tells us that:

The scientists said the discovery added weight to the argument that small changes at the coast of the continent—such as the effects of global warming—could be transmitted swiftly inland, leading to an acceleration of sea level rise.

But let's step back for a moment. The Antarctic is not warming in summer (**Figure 15**, originally from Jim Angell at NOAA), when ice might melt. Furthermore, we have a global coverage by polar orbiting satellites extending back to the late 1970's; and, for that time, we know that no significant trends are apparent in Antarctic sea-ice extent.

Better still, what did the original paper (Shepherd *et al.*, 2001), the source paraphrased by the Guardian, actually say? I quote here from its abstract:

The Pine Island Glacier (PIG) transports 69 cubic kilometers of ice each year from ~10% of the West Antarctic Ice Sheet (WAIS). It is possible that a retreat of the PIG may accelerate ice discharge from the WAIS interior. ... The thinning cannot be explained by short-term variability in accumulation and must result from glacier dynamics.

and from the body of the paper:

... the time scale for the thinning process is that of an ice dynamic fluctuation ...

There are two conclusions we can draw here (ice dynamics are discussed in Foster 1999):

- The WAIS collapse is nothing to do with greenhouse—but it needs watching.
- As a source of climate-change information, the popular press is unreliable.

6. SHANGHAI DRAFT: THE SATELLITE/SURFACE MISMATCH

The draft *Summary for Policymakers* of the impending Working Group 1 report entitled *Climate Change 2001: The Scientific Basis*, was approved and released in Shanghai on 21/1/2001.

This astonishingly one-sided account of the underlying scientific basis for 20th century climate-change gives no hint that there exist mutually-exclusive, yet still plausible, alternative hypotheses which might explain the major part of what has been observed—supported by data drawn from the peer-reviewed scientific literature. I here attribute to ‘imagination block’ the single-minded pursuit by IPCC’s WG1 (and hence, by inference, its ‘many hundreds of scientists from many countries’) of human-caused changes to the composition of the atmosphere, as the sole hypothesis worth acknowledgement.

Reviewed below, are several of the more-striking departures by IPCC’s Shanghai Draft from the quotidian rigours of scientific methodology.

In this Section, I begin on the front page, with some of the items under the bold heading:

An increasing body of observations gives a collective picture of a warming world and other changes in the climate system.

Sections below will discuss further parts of the Draft.

6.1 The 20th century surface temperature record

The first subhead sets the scene:

The global-average surface temperature has increased over the 20th century by about 0.6°C.

This subhead is amplified as follows:

The global-averaged surface temperature (the average of near surface air temperature over land, and sea surface temperature) has increased since 1861. Over the 20th century the increase has been 0.6 +/- 0.2°C. ... The record shows a great deal of variability; for example, most of the warming occurred during the 20th century, during two periods, 1910 to 1945 and 1976 to 2000.

There is no mention here of the abrupt reduction in upwelling of cold, deep water in the Pacific between 1976 and 1977 (see Section 4.2 above, and Figures 6–11). The globe is two-thirds ocean, and sea-surface temperature has a big influence on IPCC’s ‘global-averaged surface temperature’. Just how big, is now better appreciated because of the recent work by Christy *et al.* (see Section 5.2).

The re-ordering of oceanic heat transportation at 1976/77 is surely a major factor in the second of the two (roughly equal) tranches of observed surface warming in the 20th century—that at 1976–2000 (as shown in Figure 2). IPCC should have mentioned this prominent and well-documented natural event. Here is ‘imagination block’ in action.

6.2 Mismatched satellite/surface temperature trend obfuscated

The next subhead, covering the vital issue of the atmosphere/surface temperature mismatch, is confident-sounding enough:

Temperatures have risen during the past four decades in the lowest 8 kilometres of the atmosphere.

Below, I deal with IPCC's expansion of this misleading statement.

6.2.1 The longer record available from balloons

The Shanghai Draft says of the temperature trend in the lower atmosphere during the 1958–2000 period, and its comparison with surface temperatures:

Since the late 1950s (the period of adequate observations from weather balloons), the overall global temperature increases in the lower 8 kilometres of the atmosphere and in surface temperature have been similar at 0.1°C per decade.

This statement is, at the very least, economical with the truth.

Look first at the balloon record, as shown in Figures 9b and 10b. There is no warming trend in the atmosphere. Instead, there is a relatively trendless (or even, perhaps, slightly cooling) period from 1958 to 1976, a sharp jump at 1976/77 (which we know to be ocean-upwelling-related), and another relatively trendless period to the present.

Now consider the surface record. As can be seen in Figures 2 and 6a, there is a slight cooling in the period 1945–76, and a pronounced warming trend thereafter.

Compare Figure 2 with 10b. Both have slight cooling from 1958 to 1976; both have a jump at 1976/77; and there the resemblance stops. The surface keeps right on warming, and the atmosphere doesn't. IPCC's claim that global increases in atmosphere and surface temperatures 'have been similar' is not in accordance with the facts.

6.2.2 The shorter satellite-derived record

Here, IPCC has two paragraphs of explanation, from which I quote below:

Since the start of the satellite record in 1979, both the satellite and weather balloon measurements show that the global average temperature of the lowest 8 kilometres of the atmosphere has changed by $+0.05 \pm 0.10^{\circ}\text{C}$ per decade, but the global average surface temperature has increased significantly by $+0.15 \pm 0.05^{\circ}\text{C}$ per decade. The difference in the warming rates is statistically significant.

and

The lowest 8 kilometres of the atmosphere and the surface are influenced differently by factors such as stratospheric ozone depletion, atmospheric aerosols, and the El Niño

phenomenon. Hence, it is physically plausible to expect that over a short time period (e.g. 20 years) there may be differences in temperature trends.

IPCC is in denial.

If these apparent differences are valid, contrary to the IPCC view just quoted, their meaning is that warming of the lower atmosphere has not caused the observed warming at the surface, *i.e.*, the surface warming is *not* greenhouse warming.

(There is *some* greenhouse warming, of course—of which more below; but it is small relative to the warming impact of the oceanic changes at 1976/77.)

IPCC is saying that the observed atmosphere/surface difference in warming trend (as here illustrated in Figure 3) may not be real; and if only we had a longer run of data (*i.e.*, than 20 years), we might find the trends to be the same. This response can be challenged at two levels.

First, numerically:

- There has been little warming in the lower atmosphere since the 1976/77 jump, *i.e.*, for the past 24 years. Indeed, for the 22 years from 1979 for which we have good global coverage from satellites, the lower atmosphere of the Southern Hemisphere (see Figure 1a) has cooled slightly.

Second, philosophically:

- IPCC has concentrated on explaining why this apparent, and crucial, mismatch may not prove to be correct—given a longer run of (future) data. But it has not told us what it would mean to the ‘greenhouse effect’ hypothesis, if it *were* confirmed by more data.

Is this *more* ‘imagination block’?

We have here the biggest single weakness in the IPCC-promoted dominant paradigm. The information we have, albeit covering a run of only 24 years so far, shows little warming in the atmosphere. This contrasts with pronounced warming at the surface.

We *know* that the step-jump in the temperature of the lower atmosphere at 1976/77 contains in it no recognition of GHG emissions which post-date it. We *know* that there has been much less warming of the atmosphere since 1977 than at the surface on a globally-averaged basis. Finally, we *know* that, in the Southern Hemisphere, the lower atmosphere has cooled slightly, at least since 1979.

Hence, unless IPCC can conjure up a scientific miracle, we must conclude that human-caused changes to the composition of the atmosphere cannot be the main cause of the observed surface warming since 1976.

Every year for which the mismatch persists, makes IPCC’s role in the world that much less relevant.

7. SHANGHAI DRAFT: SPURIOUS ‘NEW’ EVIDENCE

The heading to this section of the Shanghai Draft says:

There is new and stronger evidence that most of the warming observed over the past 50 years is attributable to human activities.

Several disparate, but in all cases controversial, topics are discussed here.

7.1 A spurious ‘discernible human influence’

This important section of the Draft begins with a reference to the Second Assessment Report (Houghton *et al.*, 1996):

The SAR concluded: ‘The balance of evidence suggests a discernible human influence on global climate.’

Readers of RJF #1 will recall this statement in the *Summary for Policymakers* of the SAR (Houghton *et al.*, 1996).

It was repeated as a highlight of the *Preface*, but was nowhere substantiated in the text of the 567-page Report. Indeed, it was the sole scientific reference in the *Preface*, where it appeared immediately before the dubious assertion that:

... the underlying aim of this report is to provide objective information on which to base global climate change policies ...

Surprisingly, this inglorious episode has not yet been laid to rest, it seems. IPCC’s quite spurious claim—but remember, extremely influential at the time—is reviewed in detail in RJF #1 (pp 58–61 and Figures 60, 61). It is surprising, at least to me, that IPCC has chosen to resurrect it now. What are its motives? Is ‘imagination block’ an adequate explanation of its actions in this instance?

After the SAR was released, a *Nature* article (Santer *et al.*, 1996) provided an *ex post* justification. The *Nature* figure (reproduced in colour as Figure 60 in RJF #1) shows (a) model-based hemispherically symmetrical warming of the lower atmosphere from anthropogenic CO₂ emissions—other GHGs (methane etc.) are ignored; and (b) a pronounced cooling of the Northern Hemisphere from aerosols.⁹ These two graphs are combined in (c) to show (here reproduced in b&w as **Figure 16b**) net warming of the lower atmosphere in the Southern Hemisphere, particularly in the 30–60°S region.

This is as one might have expected; because the (long-lived) warming GHGs are well-mixed and globally-distributed, but 90% of the (short-lived) cooling aerosols are emitted in the Northern Hemisphere. *But*, we know that it is the Northern Hemisphere where the atmosphere is warming.

9 The distribution of anthropogenic aerosols, largely from fossil-fuel combustion but also from biomass burning, is shown in RJF #1 Figs 52, 53.

The law of empirical disproof tells us that, despite what IPCC says, aerosol cooling is not in real-life providing a significant offset to GHG warming.

However, Santer *et al.* claim (counter-intuitively, in the light of observations) to have found from balloon measurements (j) that the Southern Hemisphere is warming much as their model-based predictions show (fig j is here reproduced in b&w as **Figure 16a**). The darkened patch in the lower atmosphere at 30–60°S in Figure 16a represents a warming trend over the period of the study. It does indeed bear some resemblance in its location, as Santer *et al.* claim, to the darker area in Figure 16b, and hence to the net warming trend calculated by their combination of model-derived CO₂ warming and aerosol cooling. This ‘pattern-matching’ is the basis for IPCC’s assertion, which was so influential at Kyoto.

Santer *et al.* use this purported correspondence between model and reality to justify (after the event) the statement in the SAR *Preface*:

Further, that observations suggest ‘a discernible human influence on global climate’, one of the key findings of this report, adds an important new dimension to the discussion of the climate change issue.

How did Santer *et al.* find a warming trend in the lower atmosphere of the Southern Hemisphere, when Figure 1 shows that none exists? It was simple enough, really, according to Michaels and Knappenberger (1996): they manufactured it with their choice of data.

Figure 16c gives us the key. It shows the run of balloon records available at the time. By dropping the earliest five years of the record, the ‘trend’ can be started cool (at the time of the Mt. Agung eruption); and by dropping the latest eight years, it can be finished warm with the 1987/88 El Niño—and the subsequent cooler times associated with the 1991 Mt. Pinatubo eruption can thus be avoided.

If the full 38-year record had been used (instead of the tailored 25-year excerpt) there would have been no warming trend; there would have therefore been no matching of patterns between model and reality; and there could have been no consequent assertion by IPCC of a ‘discernible human influence on global climate’. This was not well-known outside the IPCC circle in 1996, but it is now.

It is hard to reconcile IPCC, as self-confessed provider of ‘objective information’, with its Shanghai Draft as purveyor of misinformation.

7.2 Apples and oranges in the millennium hockey-stick

The next issue covered by this section of the Shanghai Draft is the Mann *et al.* (1998, 1999) ‘hockey-stick’. The Draft says:

There is a longer and more closely scrutinised temperature record and new model estimates of variability. The warming over the past 100 years is very unlikely to be due to internal variability alone as estimated by current models. Reconstruction of climate data for the past 1,000 years (Figure 1b) also indicate that this warming was unusual and is unlikely to be entirely natural in origin.

Mann's hockey-stick, reproduced by IPCC as Figure 1b in the Shanghai Draft, is discussed at length in RJF #1 (pp , Figs 62–7). It is here illustrated in **Figure 17**.

Where are the Mediaeval Warm Period and Little Ice Age? Remember, Manns's graph is for surface temperatures in the Northern Hemisphere (the equivalent 1000-year run of data for the Southern Hemisphere is not available), where the LIA¹⁰ was most-strongly manifested (see Section 5.4 above, and Figs 4, 5). Rebound from the LIA is almost-certainly the dominant influence on the first tranche (1910–45) of observed surface warming, particularly in the Northern Hemisphere—yet IPCC doesn't even mention it.

As a reminder of the likely role in the 20th century of cyclic sea-surface temperature (and hence, climatic) variations including the LIA, I insert here selected parts of the longer quote from deMenocal *et al.* (2000) which is given in full in RJF #1 (p 25):

... these millennial-scale Holocene SST variations appear to have involved the entire North Atlantic basin, recurred with a ~1500 +/- 500 year period throughout glacial and interglacial intervals, were accompanied by terrestrial climate changes, and involved large-scale ocean and atmosphere reorganizations that were completed within decades or centuries, perhaps less. These climate perturbations continue to persist during 'our time'.

and

... Holocene climate variability has been increasing in recent millennia, with the LIA representing the largest-amplitude event of the last 20 ky. These results underscore the need to understand anthropogenic warming within the context of rates and amplitudes of natural late Holocene climate variability.

But there is yet more obfuscation to come in IPCC's shabby use of the Mann hockey-stick as the principal weapon in its struggle to show that warming over the past 100 years was 'unusual'. Beware!

The hockey-stick (Figure 17) comprises 900 years of proxy records followed by a 100 years of thermometer measurements. The contrast is striking indeed—a 900-year 'handle', and a 100-year 'blade'.

The handle is largely based on tree-ring data from high latitudes (or high altitudes). We know that trees only grow in the growing season; and that at high latitudes of the Northern Hemisphere that growing season is short—about 4–6 weeks in early summer.

But the blade is different. True, observed 20th century surface warming is largely in the Northern Hemisphere, and largely at high latitudes—particularly Siberia and, to a lesser extent, Alaska/Yukon—as shown in RJF #1 (Figs 35–37).

10 Consideration of the Little Ice Age is one of the main topics of Foster (1999), and it is also discussed in Section 3.2 'The Little Ice Age, AD 1300-1900' of RJF #1 (pp 23,4 and Figs 18-25).

The problem is that most of this measured warming is in winter, when those trees don't grow. IPCC has added apples and oranges here.

When a consistent set of tree-ring records is used throughout, as in **Figure 18**, the picture is very different; and the 20th century doesn't look 'unusual'. IPCC has been sprung!

7.3 The past 50 years, and IPCC's autistic fixation

IPCC's autistic fixation with 'human activities' (here meaning anthropogenic changes to the composition of the atmosphere) as explanation for 'most of the warming observed over the last 50 years', is illustrated by the selected quotes following:

- Simulations of the response to natural forcings alone (i.e., the response to variability in solar irradiance and volcanic eruptions) do not explain the warming in the second half of the 20th century.
- The warming over the last 50 years due to anthropogenic greenhouse gases can be identified despite uncertainties in forcing due to anthropogenic sulphate aerosol and natural factors (volcanoes and solar irradiance).
- Detection and attribution studies comparing model simulated changes with the observed record can now take into account uncertainty in the magnitude of modelled response to external forcing, in particular that due to uncertainty in climate sensitivity.
- Most of these studies find that, over the last 50 years, the estimated rate and magnitude of warming due to increasing concentrations of greenhouse gases alone are comparable with, or larger than, the observed warming. Furthermore, most model estimates that take into account both greenhouse gases and sulphate aerosols are consistent with observations over this period.

And finally, it says:

In the light of new evidence and taking into account the remaining uncertainties, most of the observed warming over the last 50 years is likely to have been due to the increase in greenhouse gas concentrations.

IPCC's observations are seriously flawed:

- First, they confer an analytical role on numerical models which is beyond their present ability.
- Second, they restrict consideration of 'natural forcings' to volcanic eruptions and variations in solar irradiance.

First, the models.

IPCC is saying two things here. Its model-based studies yield an estimated rate and magnitude of warming over the last 50 years from human-caused emission of greenhouse gases alone, which is comparable with or larger than the entire observed warming. However, when the cooling effect of anthropogenic sulphate aerosols is used as an offset, models and reality are consistent over this period.

But we *know* that aerosol cooling is negligible in real-life, because these short-lived aerosols are mostly emitted in the Northern Hemisphere. If the net outcome of their cooling and the warming by well-mixed and long-lived GHGs is (as IPCC asserts) the main cause of observed surface warming over the past 50 years, then the greater warming should be in the Southern Hemisphere.

As shown in Figure 1 for the lower atmosphere, and in RJF #1 (Fig 33) for the surface, the opposite is the case. (We now know why there is little or no aerosol cooling; as discussed in Section 5.3 above, cooling aerosols are emitted in conjunction with warming black soot, and their impacts largely cancel.)

IPCC's over-predicting models can no longer be reconciled with an under-warming world by invoking concurrent aerosol cooling. The absence of aerosol cooling leads to an important conclusion:

IPCC's numerical models are over-sensitive to, and hence over-predict, the warming impact of anthropogenic GHG emissions.

This conclusion is corroborated by real-life. IPCC's model-based calculations show the lower atmosphere warming as fast or faster than the surface. But the opposite is the case, as illustrated in RJF #1 Figs 45, 6 (the latter graph is here reproduced as Figure 3). The 'greenhouse effect' warming at the surface is the outcome of warming in the atmosphere caused by anthropogenic GHG emissions (see Section 3.2 above). If there is no prior warming of the atmosphere, that warmer atmosphere can't heat the surface.

The considerations above lead on to a second important conclusion:

IPCC is wrong when it asserts that 'most of the warming observed over the last 50 years is attributable to human activities'.

The available evidence is very much to the contrary. Most of the observed surface warming over this period (in fact over 1976–2000, because there was slight cooling from 1945 to 1976) is a result of some other agency—which did not warm the atmosphere first in order to warm the surface. It is almost-certainly a *natural* agency.

The numerical models on which IPCC relies for its warming predictions have another serious flaw, additional to their over-sensitivity to GHGs. They cannot forecast or cope with an abrupt nonlinear transition between climatic regimes, such as discussed below.

Second, the natural forcings.

Volcanoes are important drivers of climate change—provided they are large enough. For instance, albedo-related feedbacks from the Toba super-eruption about 75,000 years ago (see RJF #1, Fig 8) had a dramatic long-term impact. However, the influence of the relatively small eruptions in recent decades, although obvious at the time, is transient (as illustrated in RJF #1, Figs 42 and 50). IPCC has put up a 'straw man' here.

The Sun was much more influential in the transition of our climate from the depths of the Little Ice Age to the present, say over the last 300 years (see RJF #1 Section 3.4 ‘A place in the Sun’, pp 23–32 and Figs 24–8), than were volcanoes. In fact, variations in solar activity and their related feedbacks were collectively a much bigger factor in warming since 1750 than IPCC has shown in Figure 3 of the Shanghai Draft.

However, neither the Sun nor volcanoes—the only two natural forcings identified by IPCC—can explain the second tranche of 20th century warming at 1976–2000.

We have here a striking example of ‘imagination block’. IPCC doesn’t explain, or even mention, the abrupt nonlinear transition between climatic regimes which is so prominent at 1976/77. This is clearly the most significant climatic event of the 20th century (see Figure 2), and its various manifestations are amply documented in the peer-reviewed scientific literature. Furthermore, and of crucial importance in the context of IPCC’s work, it appears to be unrelated to the ‘greenhouse effect’.

Much of my second supplementary submission to JSCOT (RJF #2, ‘Climate-change science: duel of the hypotheses’) is devoted to a discussion of this signal event, and the information is summarised above in Section 4.2, and illustrated in Figures 6–12.

In its Shanghai Draft, IPCC gives no hint that its ‘Greenhouse Effect’ Hypothesis is under siege—from the facts. My ‘Oceanic Impedance’ hypothesis, based on a major re-ordering of oceanic heat transportation at 1976/77, is in better conformity with the known facts relating to climate change in the last 50 years.

These hypotheses are mutually exclusive. The main cause of the ‘warming observed over the last 50 years’ cannot be both human-caused changes to the composition of the atmosphere *and* natural factors.

We have incommensurable paradigms here.

8. SHANGHAI DRAFT: SPURIOUS WARMING PROJECTIONS

8.1 Flawed input to flawed models

I deal here with two succeeding, and closely related, sections of the Shanghai Draft. The first has the headline:

Human influence will continue to change atmospheric composition throughout the 21st century.

This section of the Draft discusses the IPCC Special Report on Emission Scenarios (SRES), and tells us that IPCC's range of atmospheric concentrations for CO₂ (the principal GHG) in 2100, as used in calculating its projections of global warming by that time, are 490 to 1260 ppm when allowance is made for uncertainties in land and ocean feedbacks.

These figures can be compared with a pre-industrial level of 280 ppm in 1750, and about 368 ppm today. The atmospheric CO₂ concentration has varied over time. At the start of the Tertiary, some 60 million years before the present, it was 2–4 thousand ppm (see RJF #1, Fig 1), and had declined to about 190 ppm by the end of the Last Glacial, some 15,000 years ago.¹¹ At the time detailed monitoring began in 1958, the concentration had risen to 315 ppm.

The issues here are two.

- How good are IPCC's projections of the extent to which GHG concentrations will rise over the next century?
- How sensitive are IPCC's models to increasing GHG concentrations?

In the last 250 years, CO₂ concentration has risen by some 88 ppm including 53 ppm since 1958. Thus for the last 42 years, the concentration has been rising by about 13 ppm per decade. IPCC's low bound indicates continued increase at 10 ppm/decade through the century ahead; but its extreme case implies an average increase of about 74 ppm/decade from now right through to 2100.

When the latter implausibly-high projection is used as input by models which we know to be inherently over-sensitive to GHG emissions, an implausibly high forecast of future warming is the inevitable output.

But why harp on the *extreme* case? After all, there are 35 SRES scenarios from which to choose. There is a very good reason for doing so. The popular press, and even the news pages in the best scientific journals, emphasise in their reporting the extreme case—in preference to a more-likely outcome. Unsurprisingly, the least-extreme projection enjoys no emphasis. Who can blame opinion-formers in our society if all they remember is the worst-case scenario?

¹¹ Here following Harry N.A. Priem of the Department of Earth Sciences at Utrecht University.

8.2 Flawed output from flawed models

The second of the Draft's two closely-related headlines is:

Global average temperature and sea level are projected to rise under all IPCC SRES scenarios.

This submission will not further discuss sea level. The topic is covered briefly above in Section 5.5 'Present-day surging of the West Antarctic Ice Sheet'; see also RJF #2 Fig 27. Much more detail is contained in Foster (1999) under the heading 'Looking ahead: West Antarctic ice-sheet'.

Of direct relevance to this submission are the first two explanatory points. One is:

- The globally averaged surface temperature is projected to increase by 1.4 to 5.8⁰C over the period 1990 to 2100. These results are for the full range of 35 SRES scenarios, based on a number (*i.e.*, 7) of climate models.

A forecast warming of 1.4⁰C is not the stuff which might win the battle of hearts and minds. But 5.8⁰C is a different matter indeed. It is the latter figure which is so often quoted—the highest of IPCC's 35 x 7 = 245 projections.

Figure 19 shows IPCC's hockey-stick (from Mann *et al.* 1999) at a reduced vertical scale, so that IPCC's range of projected warming will fit on the graph (Figures 19–21 are from the contrarian website of the coal-industry-funded Greening Earth Society). Also shown, is a plausible range for climate change over the same period if natural factors were to be the main driver of changing climate in the next century. In order to illustrate the enormity, and I say implausibility, of IPCC's most extreme forecast, **Figure 20** reproduces the hockey-stick at a 'normal' vertical scale. In this case the outcome for 2100 falls way outside the graph—where it can be seen at the very top of the page.

The second relevant point in the Draft is:

Temperature increases are projected to be greater than those in the SAR, which were about 1.0 to 3.5⁰C based on the six IS92 scenarios. The higher projected temperatures and the wider range are due primarily to the lower projected sulphur dioxide emissions in the SRES scenarios relative to the IS92 scenarios.

If I understand these words correctly, IPCC is saying that the projected upper bound of warming by 2100 has jumped from 3.5⁰C in 1996 to a much-more-scary 5.8⁰C now, due primarily to an expectation of lower sulphur dioxide emissions than previously assumed. This conclusion is crucial to any judgement of the veracity of IPCC's warming projections.

That I *have* got it right, is confirmed by a recent exchange in *Nature* between Pielke and Stocker.¹²

12 Roger A. Pielke Jr is at the National Centre for Atmospheric Research at Boulder; Thomas Stocker is at the Physics Institute, University of Bern.

Pielke (2001) in an article entitled ‘Room for doubt’, and accompanied by a box containing the words ‘Consensus science can only provide an illusion of certainty’, criticises IPCC’s methodology, at least in a conceptual sense:

... in 1990 ... (IPCC) projected that a doubling of CO₂ in the atmosphere would result in a 1.5 to 4.5⁰C mean global temperature change. In 2001, after tens of billions of dollars of investment in global-change research, the IPCC now concludes that a doubling of CO₂ will result in a 1.5 to 6.0⁰C temperature change. Even as the IPCC has become more certain that temperature will increase, the uncertainty associated with its projections has also increased. Why? Researchers have concluded that there are many more scenarios of possible population and energy use than originally assumed

and

... efforts to reduce uncertainty via ‘consensus science’—such as scientific assessments—are misplaced. Consensus science can provide only an illusion of certainty. When consensus is substituted for a diversity of perspectives, it may in fact unnecessarily constrain decision-maker’s options.

and finally

As a general principle, science and technology will contribute more effectively to society’s needs when decision-makers base their expectations on a full distribution of outcomes, and then make choices in the face of resulting—perhaps considerable—uncertainty.

Predictably, IPCC’s response was not long delayed. On the next week’s correspondence page was a letter (Stocker 2001) which began:

I read with interest your News article covering the approval of the Third Assessment Report of the Intergovernmental Panel Change Working Group 1 in Shanghai in January. As a coordinating lead author of one of the chapters, lead author of the technical summary and a member of the drafting team of the summary for policy-makers, I would like to clarify (a point).

... although climate modelling has advanced during the past five years, this is not the main reason for the revised range of temperature projections. The higher estimates of maximum warming by the year 2100 stem from a more realistic view of sulphate aerosol emissions. The new scenarios assume emissions will be reduced substantially in the coming decades, as this becomes technically and economically feasible, to avoid acid rain. Sulphate emissions have a cooling effect, so reducing them leads to higher estimates of warming.

Here we have it. Clear as a bell!

The increased projections of warming by 2100, as contained in the Shanghai Draft are fatally flawed. They rely on the implausible assumption that techniques for removing particulates from stack-gases will take out the (cooling) sulphates, while leaving in the (warming) soot. How could IPCC’s ‘many hundreds of scientists’ let this through?

8.3 The views of Lindzen and Christy

If it is possible for a scientist to be both ‘mainstream’ *and* outside the dominant paradigm of the day, Lindzen and Christy are good examples.

I repeat here part of the quote given in Section 5.1 above which reports the new work of Lindzen *et al.* (2001):

If this ‘iris effect’ is found to be a general process active in tropical oceans around the world, the Earth may be much less sensitive to the warming effects of such influences as rising greenhouse gas concentrations in the atmosphere. The researchers estimate that this effect could cut by two-thirds the projected increase in global temperatures initiated by a doubling of carbon dioxide in the atmosphere.

Figure 21 contrasts IPCC’s projections with a revised version including the Lindzen *et al.* reductions. As you will see, there is a big difference—and it would be bigger if IPCC’s ill-founded treatment of aerosol cooling were also corrected.

A recent (20/2/01) interview with Christy¹³ by *The Times* of London had the headline ‘The future outlook is fine’ and subheading ‘The latest doomsday weather scenarios are wrong, a US expert tells ...’ Part of the piece is:

Last week climate researchers ... predicted a malaria epidemic in East Anglia within 50 years, and last month weather experts warned that the Earth’s temperature could rise by 6C by 2100

and

‘The world is in much better shape than this doomsday scenario paints’, say Christy ... ‘There were 245 different results in that report, and this was the worst-case scenario. It’s the one that’s not going to happen. It was the extreme case of all the things that can make the world warm.’

and finally

‘You should approach climate models with a degree of awe and a sense of humour’, he says. ‘They are incredible accomplishments of code-writing, but they are not the real world. They have many shortcomings—the sort of tiny shortcomings that can make long-term predictions suspect.’

But what about malaria? ‘Don’t worry’ is the message:

And malaria on the Norfolk Broads? ‘It is a red herring,’ Christy says, ‘Malaria is not a warm weather disease and was endemic in Britain in the 19th and early 20th centuries. It is constrained by simple public health measures. In countries wealthy enough to support a good public health infrastructure, there is little or no malaria, such as Singapore and northern Australia.’

8.4 IPCC’s projections to 2100 are spurious

The public is being led by the nose—the rope being the most extreme of IPCC’s 245 projections. When it was leaked in the days immediately before the US presidential election, reports of ‘up to 6°C warming by 2100’ predicted in the *Summary for Policymakers* of the Third Assessment Report, became a potent weapon in the battle for hearts and minds—although, as it turns out, not quite potent enough to win the election.

However, IPCC’s entire suite of TAR warming projections as approved at Shanghai, not just the most extreme of them, is without predictive merit because:

13 John R. Christy is Professor of Atmospheric Science, and Director of the Earth System Science Centre, at the University of Alabama in Huntsville.

- All the model-based projections have the lower atmosphere warming as fast or faster than the surface; and yet we know that, for the last 24 years, the surface has warmed the faster in real-life. Clearly, the models are flawed.
- Current numerical models cannot forecast, or cope with, an abrupt nonlinear transition between climatic regimes, such as that caused by impedance of oceanic heat transportation in response to (probably ice-surge-related) inertial changes.
- We know that there was in real-life just such an event at 1976/77. It took the form of a major re-ordering of oceanic heat transportation, in conjunction with an abrupt reduction in the upwelling of cold, deep water in the Pacific. This was the most prominent climatic transition in the 20th century, it has not yet reversed, and yet IPCC's models ignore it.
- The inertial impacts of present-day surging of glaciers on the West Antarctic Ice Sheet, and of their probable continued surging, are ignored in IPCC's models.
- Hindcasting over the past century shows that IPCC's models over-predict the warming resulting from human-caused greenhouse gas emissions. It is only when concurrent cooling by sulphate aerosols is invoked, that the models can be reconciled with real-life.
- But we know that aerosol cooling was negligible in real-life for at least the last 22 years, because 90% of the cooling aerosols are emitted in the Northern Hemisphere, and yet it is this hemisphere which had the greater warming in the lower atmosphere *and* at the surface. (In fact, in the Southern Hemisphere—*sans* cooling aerosols—the lower atmosphere cooled slightly over the period.)
- Without countervailing cooling by aerosols, the over-prediction in IPCC's models of warming by GHG emissions is confirmed.

All the above could have been written a year ago. Now there is more:

- The new warming projections for 2100 in IPCC's 2001 TAR (ranging up to 5.8⁰C) are higher than in its 1996 SAR (up to 3.5⁰C) primarily because IPCC now assumes increasing capture of aerosols from the products of fossil-fuel combustion. But the techniques (*eg.* filtration or precipitation) for removal of particulates from stack-gases can't be expected to take out the light-coloured (cooling) sulphates while leaving in the dark-coloured (warming) soot. Hence, as today, the net effect will be negligible.

IPCC's projections are doubly spurious—and even worse if Lindzen *et al.* are correct.

9. CONCLUSIONS

The Shanghai Draft says: *there is new and stronger evidence that most of the warming observed over the last 50 years is attributable to human activities.* We all know there was slight cooling at the surface at 1945–76, and so IPCC must be talking of 1976–2000 warming. We also know that there was human-caused warming during that time from urbanisation and land-use changes; but IPCC means *greenhouse* warming.

However, **the 1976–2000 warming is unlikely to be from the ‘greenhouse effect’**, because there is no substantial trend of rising temperature in the lower atmosphere over that time—beyond the 1976/77 jump. On the other hand, and not mentioned by IPCC, there was a major re-ordering of oceanic heat transportation between 1976 and 1977. This event provides a better-founded explanation for the observed surface warming at 1976–2000 than does IPCC’s implausible attribution to human-caused changes in the composition of the atmosphere. Is IPCC an authoritative and unbiased source of advice on climate-change science? Or is it just another vested interest?

IPCC is under pressure. Globally-averaged near-surface temperature increased by only 0.6°C over the past century—largely in the Northern Hemisphere, over land, and in winter. Continued increase at this rate until advent of the next ‘Little Ice Age’ means little in the great scheme of things. (Recent work indicates there is a good chance that even this modest warming will prove to have been overstated.) To compound IPCC’s problem, the observed warming can’t be attributed to the greenhouse effect. We are dealing with natural variability here—just *business as usual*.

The weight of new evidence—awkward and unwelcome as it is—raises questions about IPCC’s reason for existing. Pressure of facts is forcing it into, in my opinion quite untenable, positions as a matter of self-preservation. **IPCC’s new projection** of a globally averaged surface temperature increase of up to 5.8°C by 2100 is here seen as evidence of this desperation.

The greenhouse effect is not the primary cause of the observed 1976–2000 warming. The next question becomes: is there any ‘greenhouse effect’ warming evident at the Earth’s surface over the period. The answer is, almost certainly: ‘yes’. Observed warming in the intensely cold, and very dry, high pressure cells at high latitudes in winter (of which that over Siberia is the most prominent)—where masking by water vapour is absent—is likely to be greenhouse warming.¹⁴

My disagreement with IPCC is not over whether there is *any* anthropogenic greenhouse effect. It is over whether GHGs caused *most* of the warming over the past 50 years. The evidence available points to a larger, natural, cause for the warming observed in the 1976–2000 period. But then, if we ‘do the right thing’ about GHG emissions, can we stabilise our climate? Forget IPCC; the answer is: ‘no’.

14 Here relying particularly on work by Patrick J. Michaels.

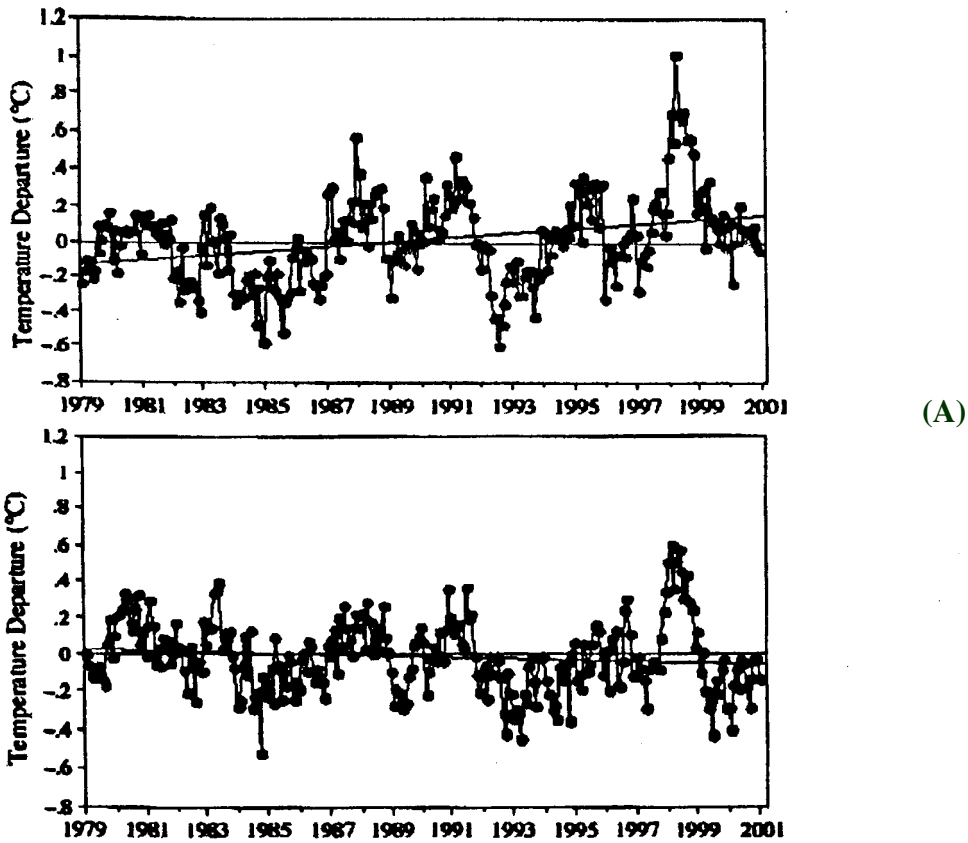
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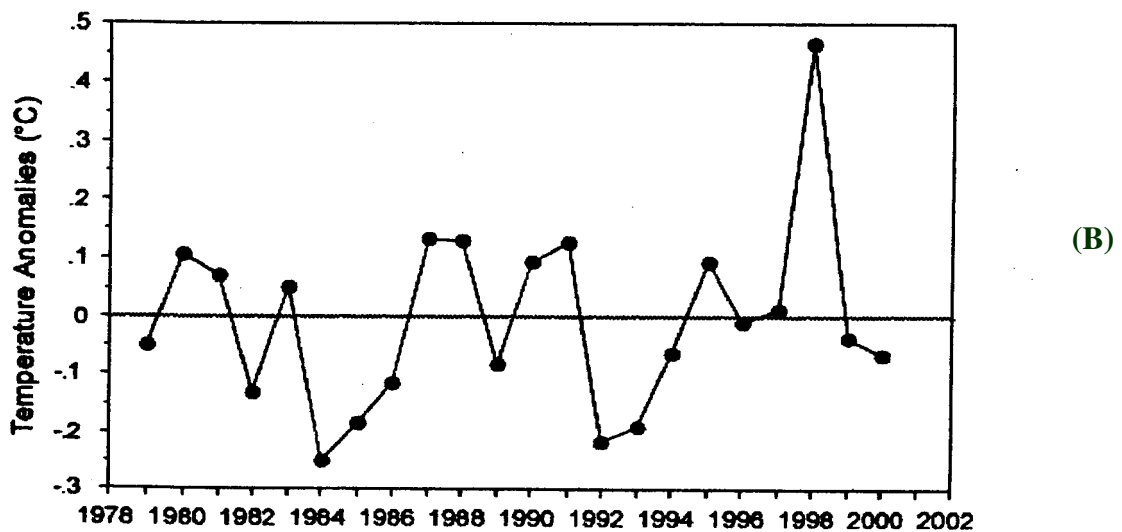
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FIGURE 1: SATELLITE-DERIVED ATMOSPHERIC TEMPERATURE



Monthly satellite temperatures for the Northern Hemisphere (top) and Southern Hemisphere (bottom). Trend lines indicate statistical significance.

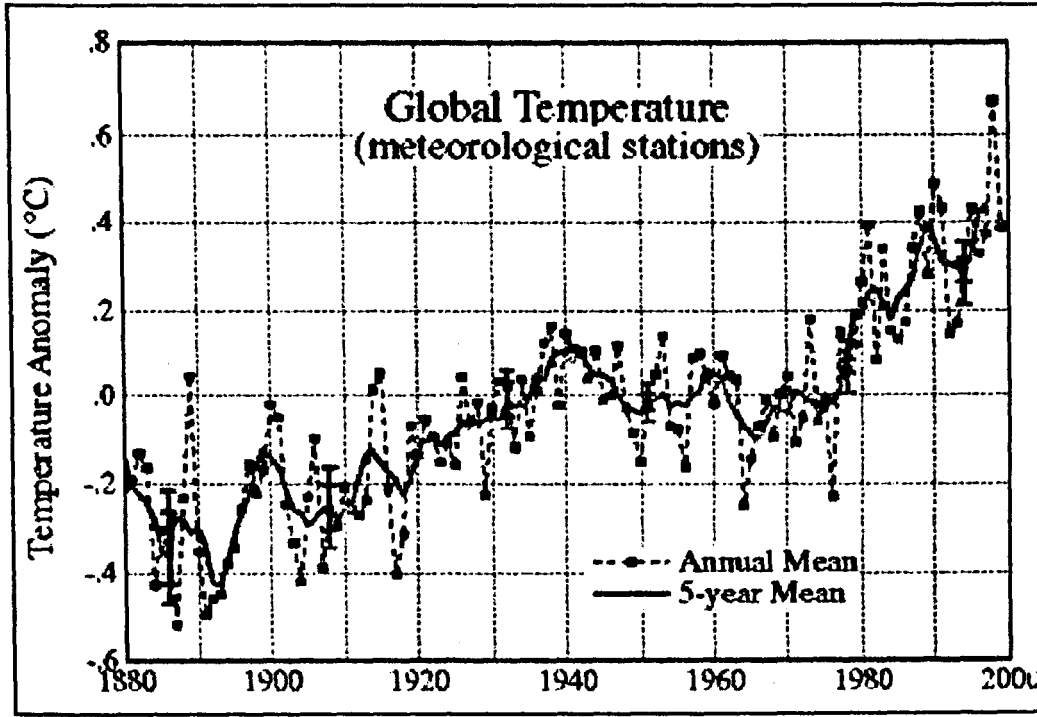


Global satellite temperature records for the year 2000 reveal that last year fell below the long-term (22-year) mean. There is no longer any statistically meaningful trend in satellite-measured mean annual lower tropospheric temperatures.

IPPC's Third Assessment Report: Too Much 'Imagination Block'—Figures

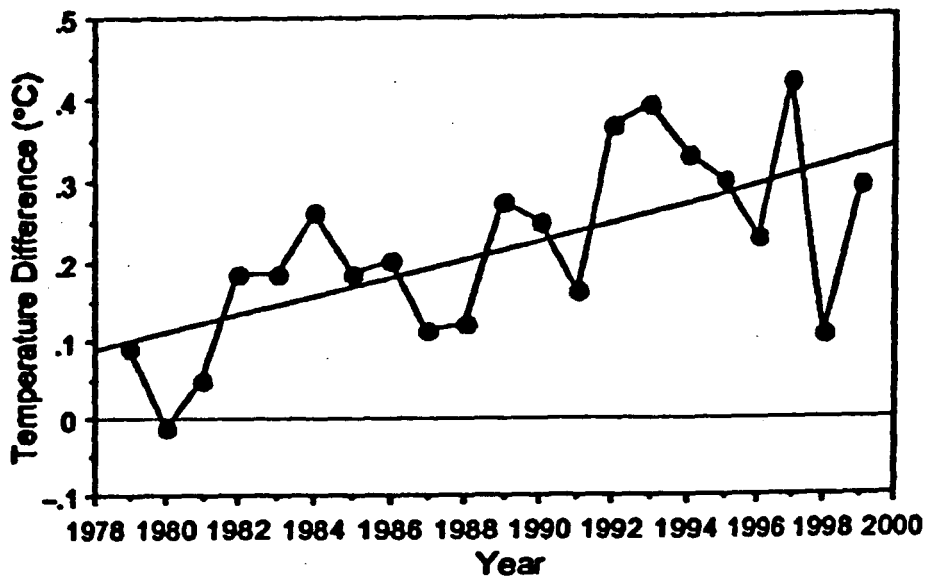
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FIGURE 2: OBSERVED GLOBAL SURFACE TEMPERATURE



John Daly 2000

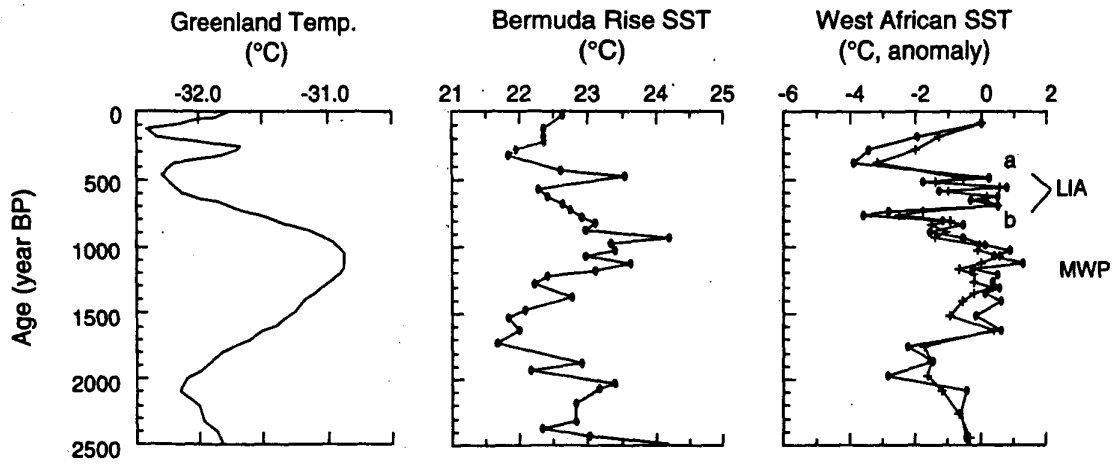
FIGURE 3: GROUND/SATELLITE TEMPERATURE DIFFERENCE



World Climate Report 2000

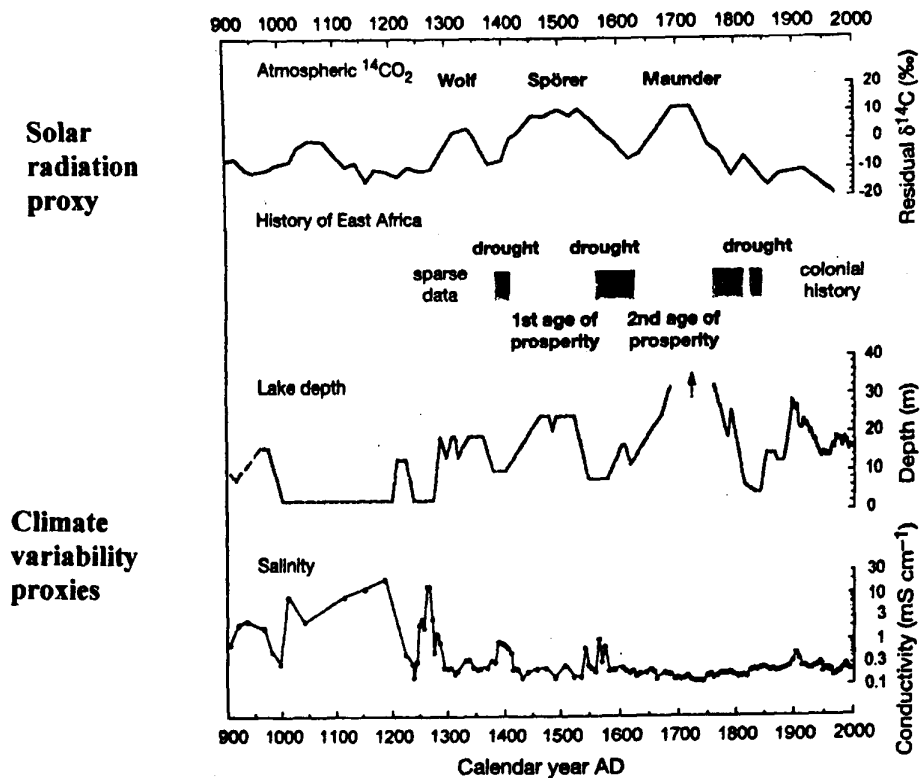
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FIGURE 4: LITTLE ICE AGE & MEDIAEVAL WARM PERIOD TEMPERATURES



deMenocal *et al* 2000, *Science* v 288

FIGURE 5: EAST AFRICAN CLIMATE VARIABILITY



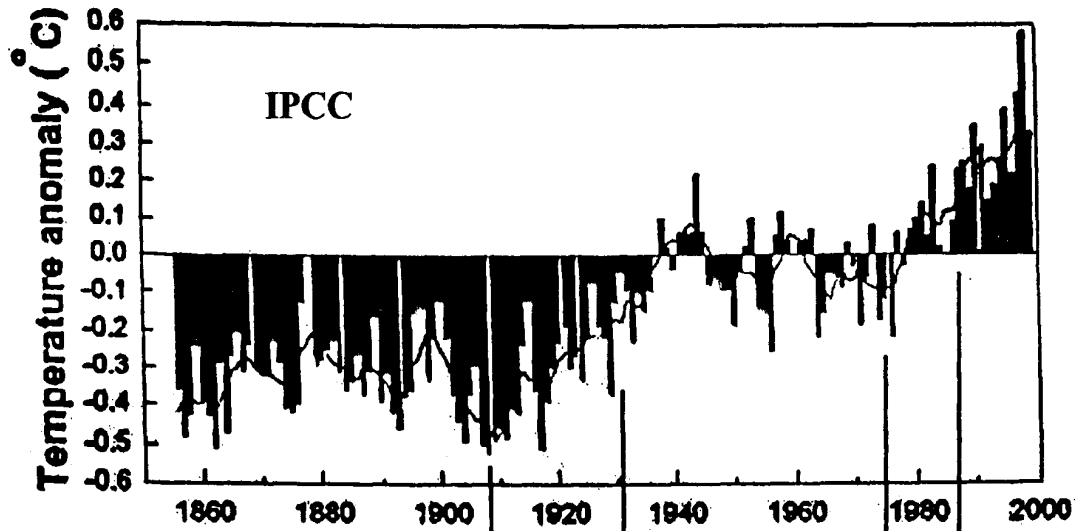
Verschuren, Laird & Cumming 2000, *Nature* v 403

IPPC's Third Assessment Report: Too Much 'Imagination Block'—Figures

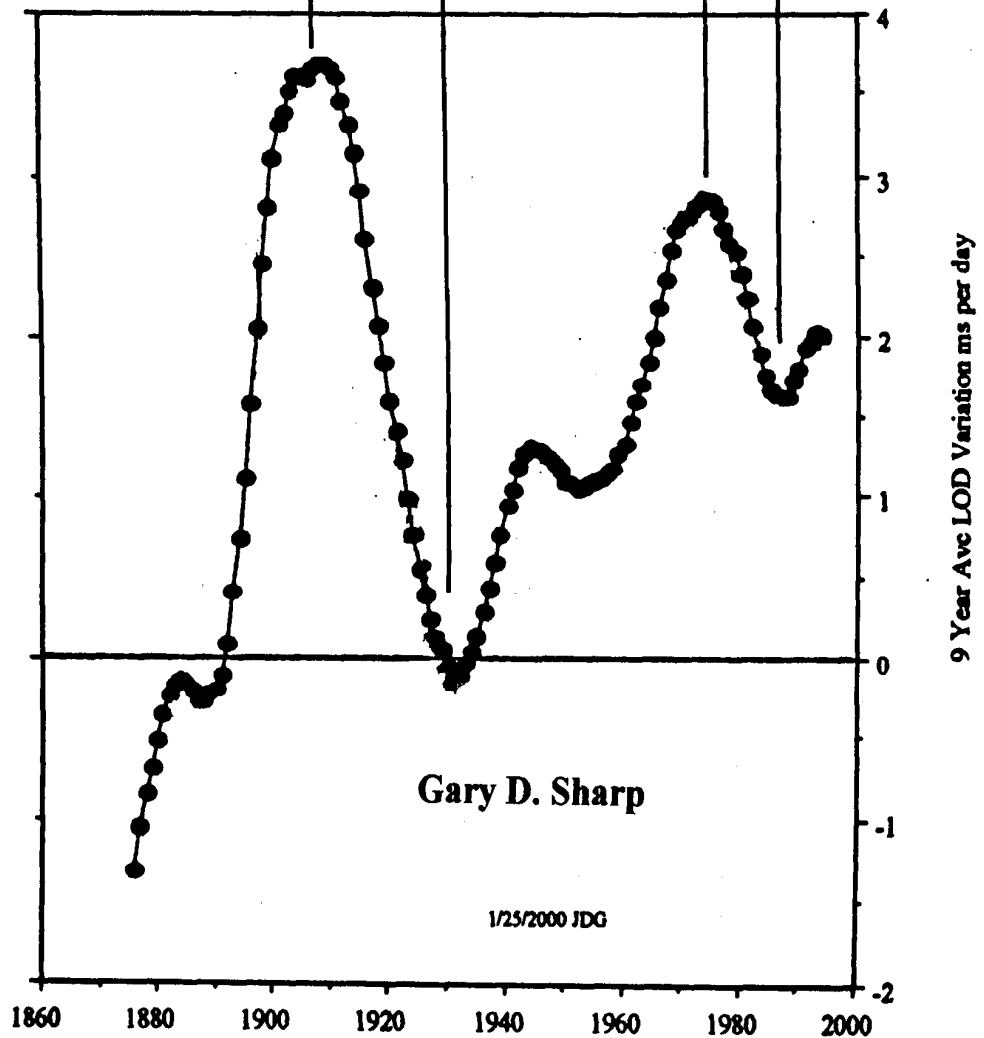
Click the 'Go to Previous' arrow: ◀ in Acrobat Reader to return to the text .
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FIGURE 6: GLOBAL MEAN SURFACE TEMPERATURE CHANGES COMPARED TO TREND CHANGES IN LENGTH OF DAY VARIATION

(A)

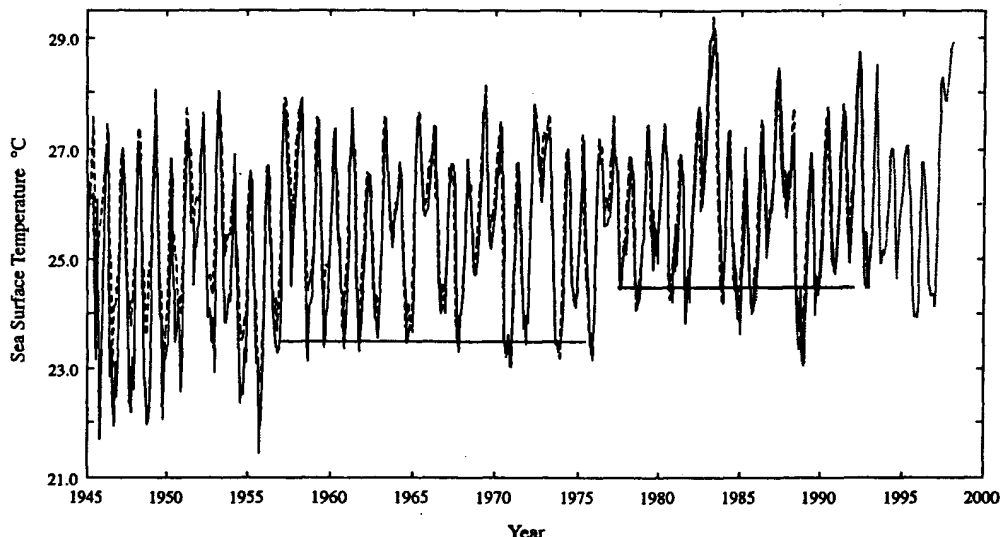


(B)



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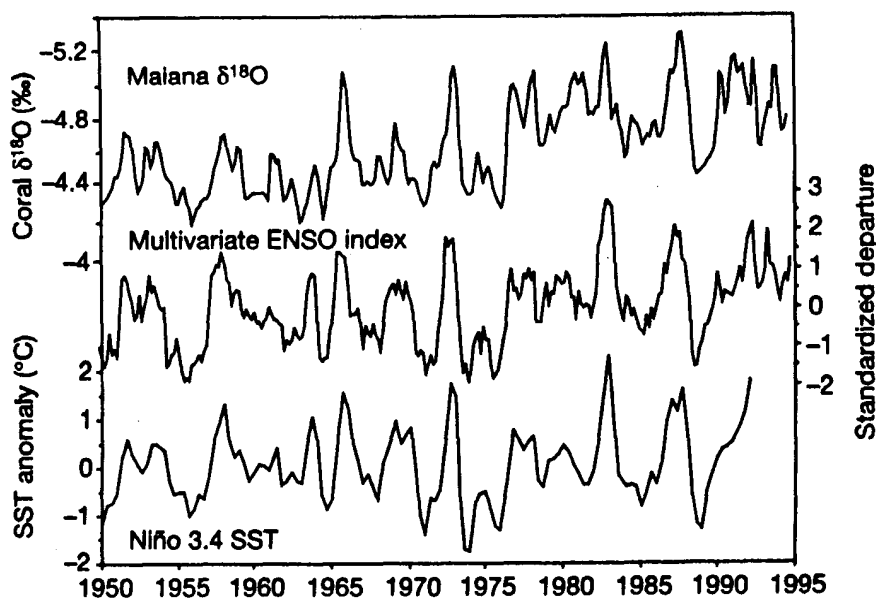
FIGURE 7: SEASONAL TROPICAL PACIFIC SEA-SURFACE TEMPERATURES



SSTs in the Niño-3 region (90° to 150°W, ±5°) as observed in COADS (solid line), GOSTA (dashed line), and NMC/IGOSS (dotted line) databases. Warm season SSTs have remained relatively invariant, whereas upwelling season SSTs underwent a step-like warming in 1976.

Guilderson & Schrag 1998, *Science* v 281

FIGURE 8: OXYGEN ISOTOPE CLIMATE PROXY FROM CORALS AT MAIANA (1°N, 173°E), CENTRAL PACIFIC

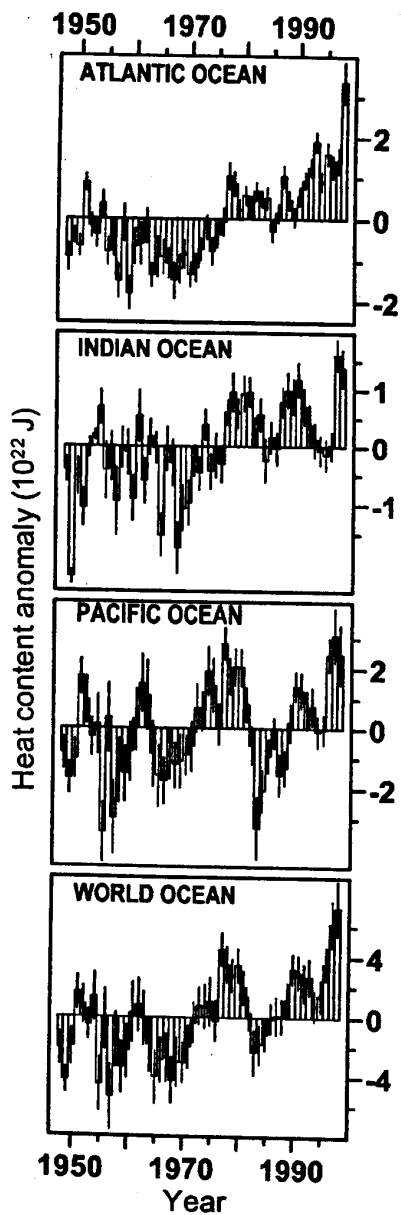


Bimonthly records of tropical Pacific variability from coral and instrumental data. Maiana coral $\delta^{18}O$ compared to the Multivariate ENSO index and Niño 3.4 SST.

Urban, Cole and Overpeck 2000, *Nature* v 407

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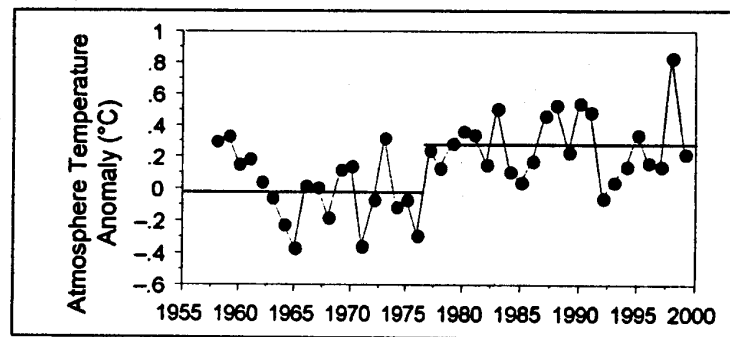
FIGURES 9A AND 9B



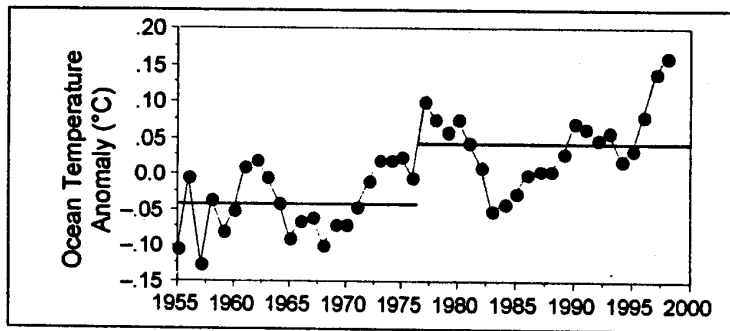
(A) OCEANIC HEAT CONTENT:
UPPERMOST 300 METRES

Levitus *et al* 2000, *Nature* v 287

(B) COMPARISON OF GLOBAL
AND ATMOSPHERE TEMPERATURES



Weather balloon measurements of temperatures in the lower atmosphere show a jump in about 1976.



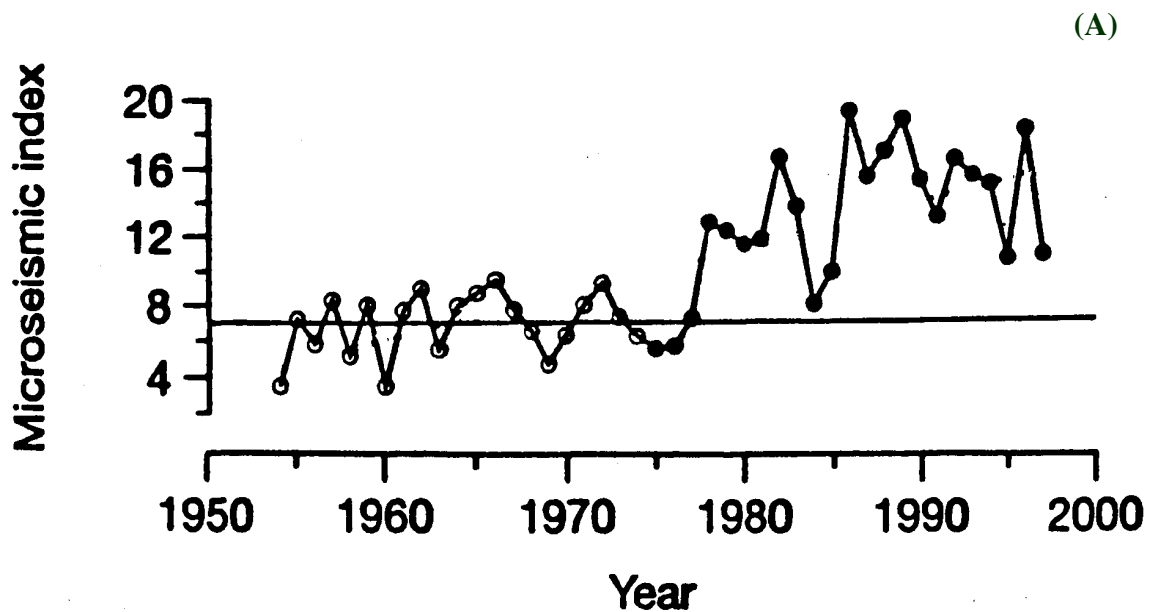
New findings from Levitus, who measured ocean temperatures, also reveal this shift.

World Climate Report 2000, v 5 no 14

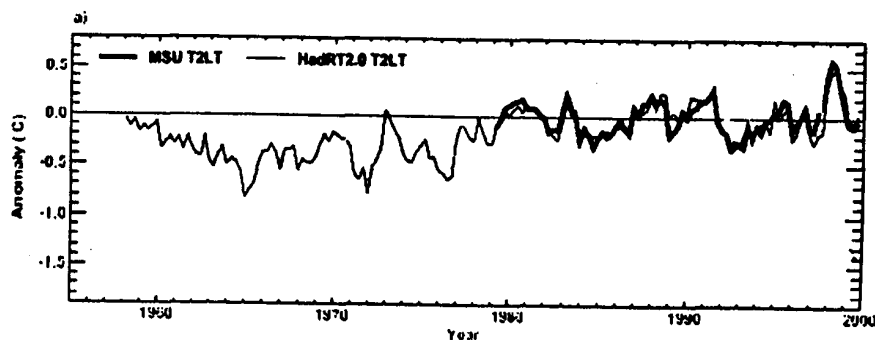
IPPC's Third Assessment Report: Too Much 'Imagination Block'—Figures

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FIGURE 10: EUROPEAN WAVE CLIMATE vs ATMOSPHERIC TEMPERATURE



Grevemyer, Herber & Essen, *Nature* v 408



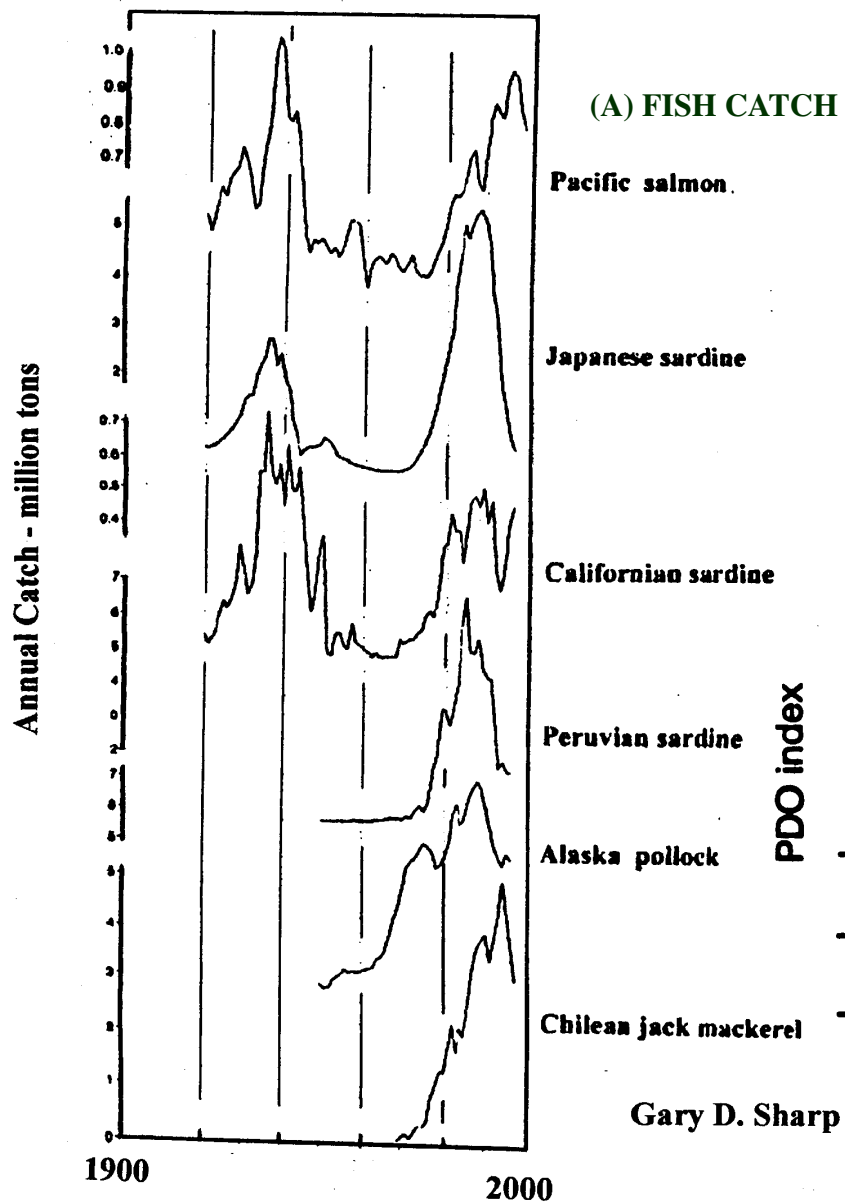
Weather balloon (radiosonde) temperature anomalies in lower atmosphere from 1956, with satellite (MSU) readings, from 1979. (Parker et al 1997)

Vincent Gray 2000, *Energy & Environment* v 11 no 6

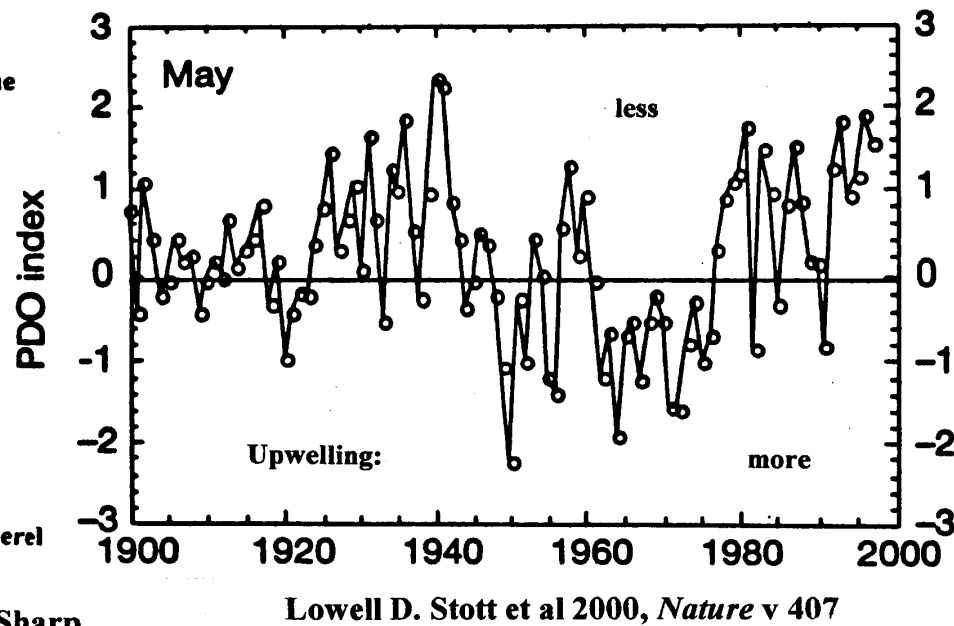
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Alternatively, use the text and figures Bookmarks for navigation.

FIGURES 11A AND 11B

(A) FISH CATCH IN THE EASTERN PACIFIC

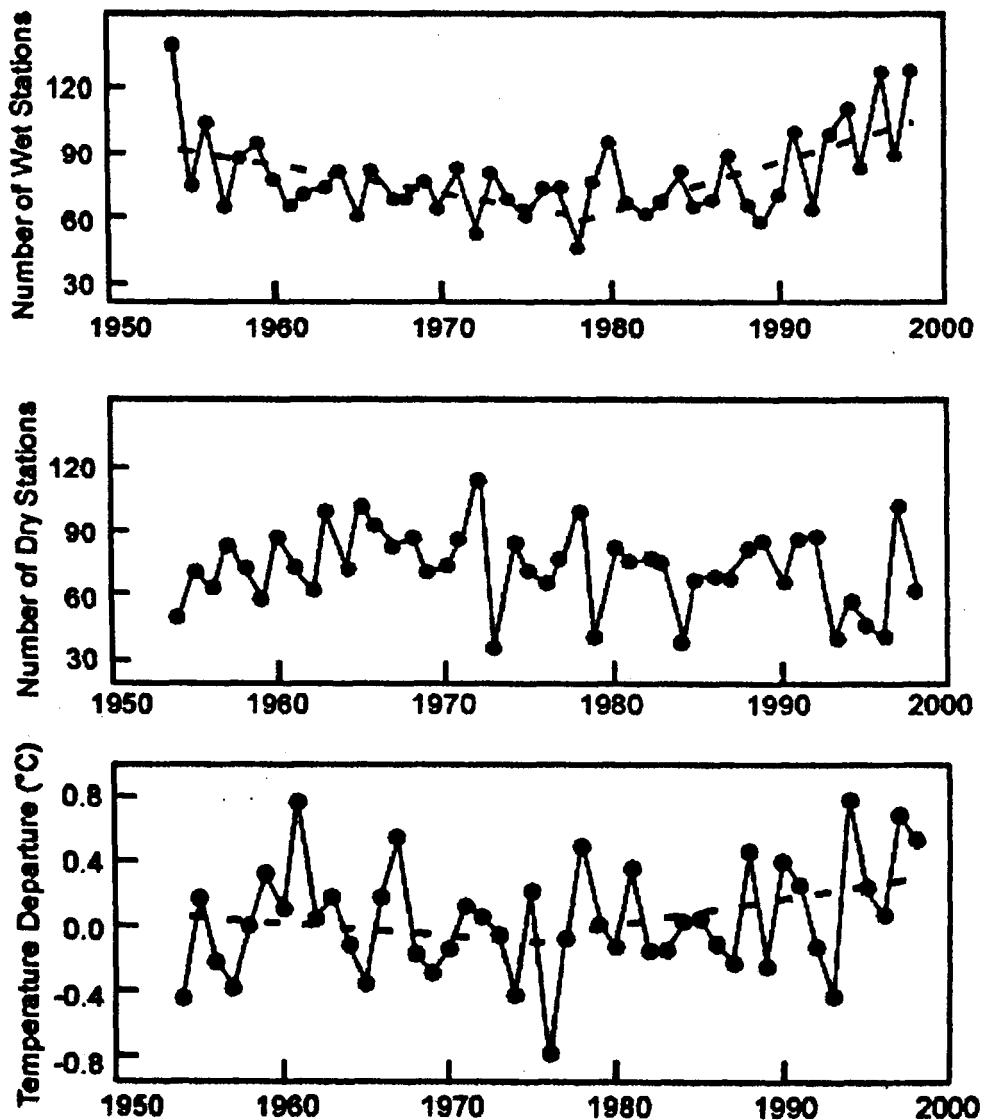


(B) UPWELLING INDEX FOR THE NE PACIFIC



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Alternatively, use the text and figures Bookmarks for navigation.

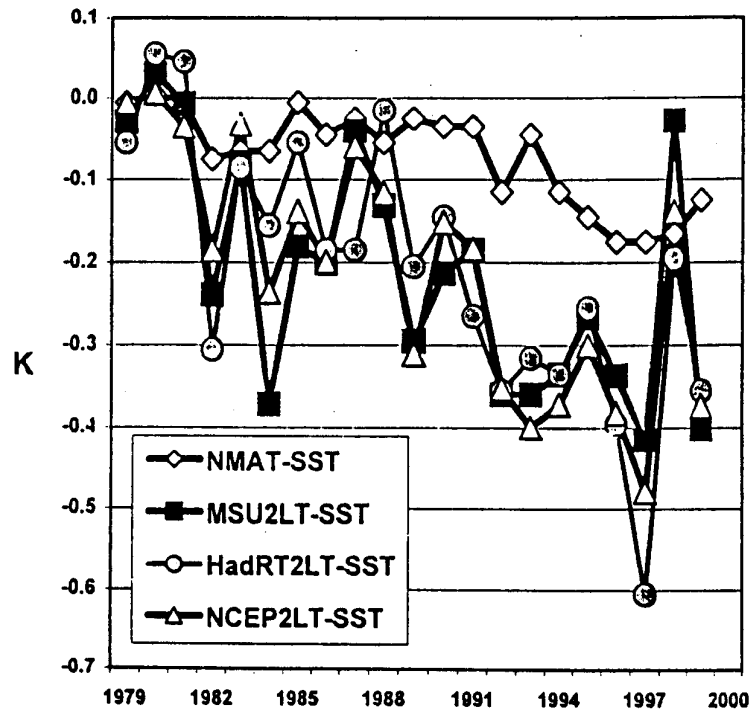
FIGURE 12: TEMPERATURE vs SUMMER RAINFALL IN E. CHINA



Top: The number of stations in eastern China with summer precipitation above the 80th percentile ("severe wet" stations). Middle: The number of stations in eastern China with summer precipitation below the 20th percentile ("severe dry" stations). Bottom: Temperature history of eastern China.

FIGURE 13: SEA-SURFACE IS WARMING FASTER THAN OVERLYING AIR

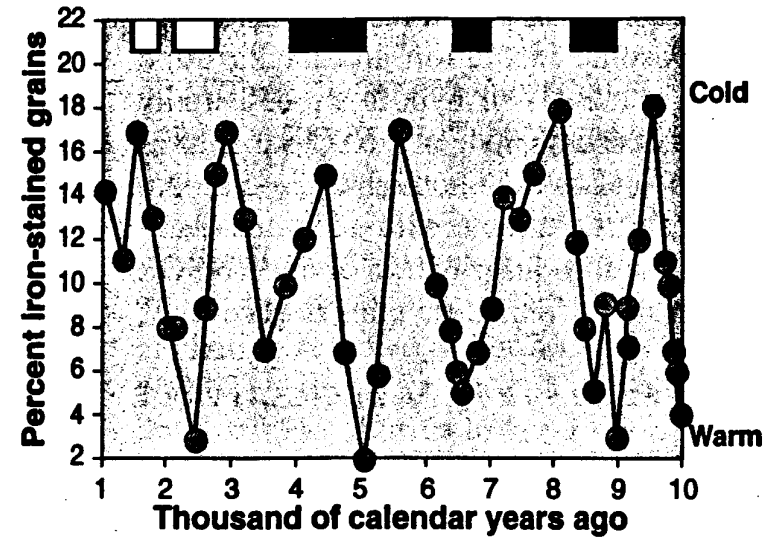
Air Temperature Anomalies minus SST Anomalies, 1979-1999 Tropics (20°S-20°N)



Annual differences of anomalies of various tropical (20°S-20°N) air temperature values versus sea surface temperature with 1979-1980 as the base. Dataset names are identified in the text. Note that all measures of air temperature indicate less positive trends than observed by sea surface temperatures.

John R Christy 2001, *Geophysical Research Letters* v 28 no 1

FIGURE 14: EVIDENCE FOR A CYCLIC HOLOCENE CLIMATE

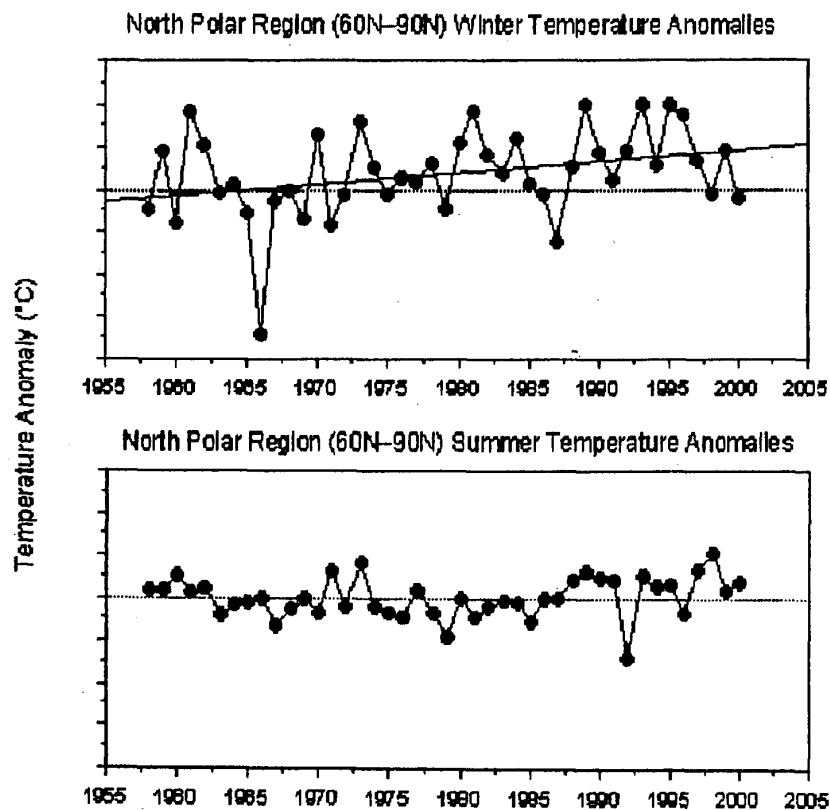


Climatic oscillations during the Holocene. Circles show the ratios of iron-stained to total grains (for grains with diameters >63 μm) in a North Atlantic core. The boxes are based on radiocarbon dating on wood and peat formed when the glaciers had retreated to positions similar to or up-valley from those at present.

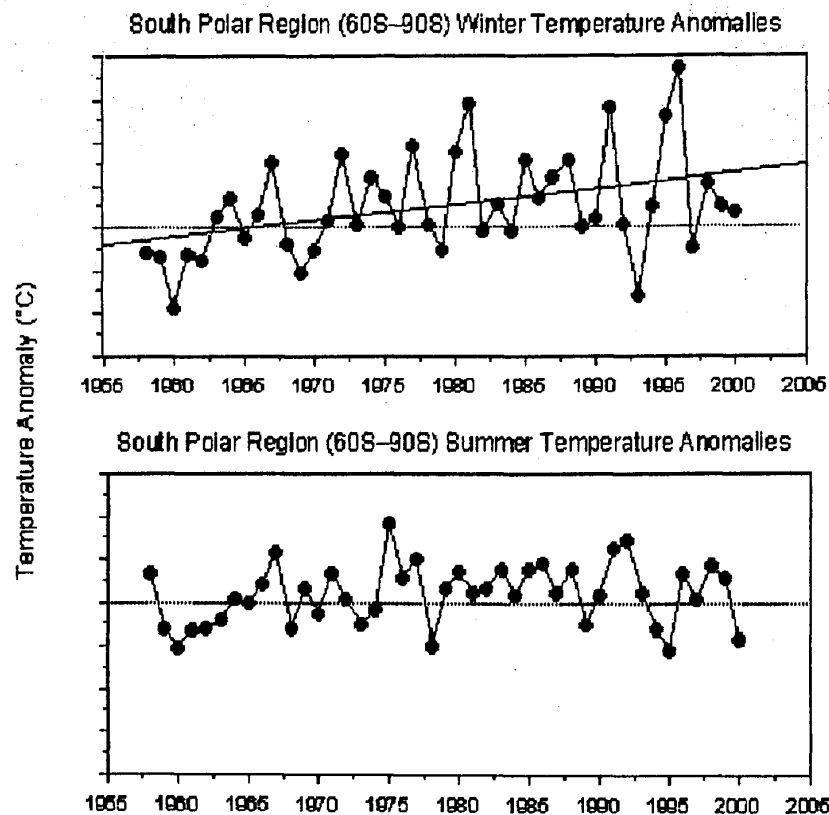
Wallace S Broecker 2001, *Science* v 291

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FIGURE 15: HIGH LATITUDE SURFACE-AIR TEMPERATURES



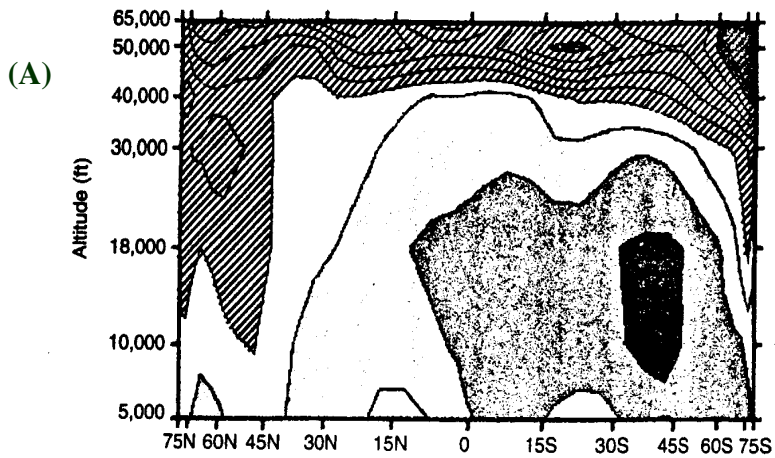
The trend in surface temperatures as measured at the point-of-release of weather balloons for the winter (top) and summer (bottom) seasons in the North Polar region (between 60N and 90N). There is a statistically significant warming trend of 2.6°C/100 years in the winter, but no significant change in the summer.



The trend in surface temperatures as measured at the point-of-release of weather balloons for the winter (top) and summer (bottom) seasons in the South Polar region (between 60S and 90S). Just as in the North, there is a warming trend in winter temperatures (3.7°C/100 years), not evident in summer temperatures.

<http://www.greeningearthsociety.org/Articles/2001/vca9.htm>

OBSERVED TEMPERATURE CHANGES ON THE LOWER ATMOSPHERE
AS PUBLISHED BY SANTER ET AL., 1996



TEMPERATURE CHANGES PROJECTED BY THE TAYLOR AND PENNER
MODEL WITH SULFATE AND GREENHOUSE GASES

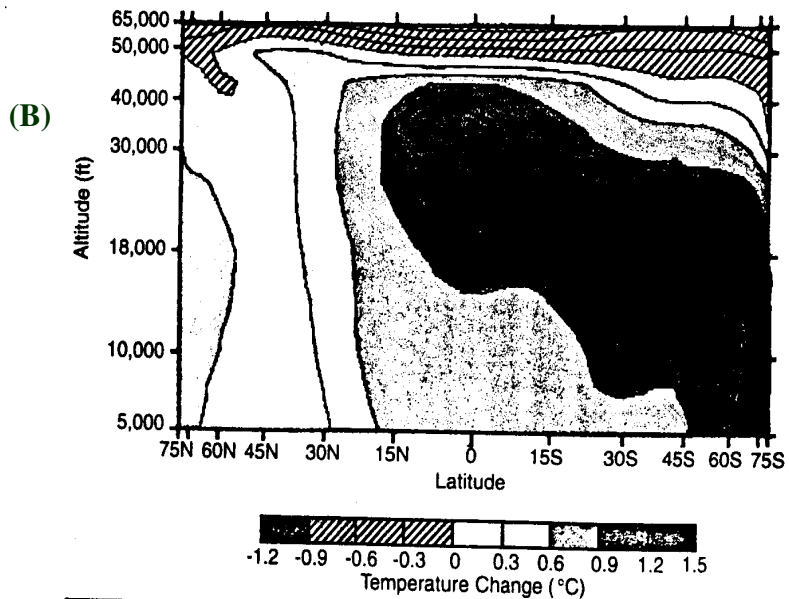
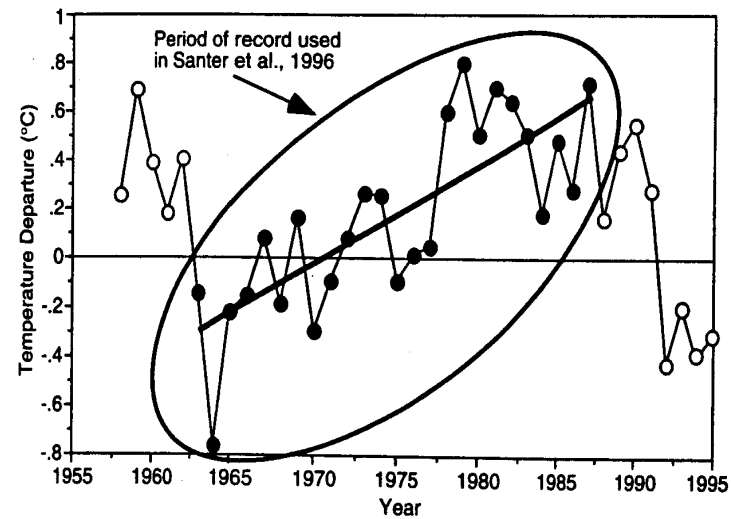


FIGURE 16: HUMAN EFFECT ON
GLOBAL CLIMATE?

WARM REGION TEMPERATURE HISTORY, 1958-95 (C)



SOURCE: Michaels and Knappenberger, 1996.

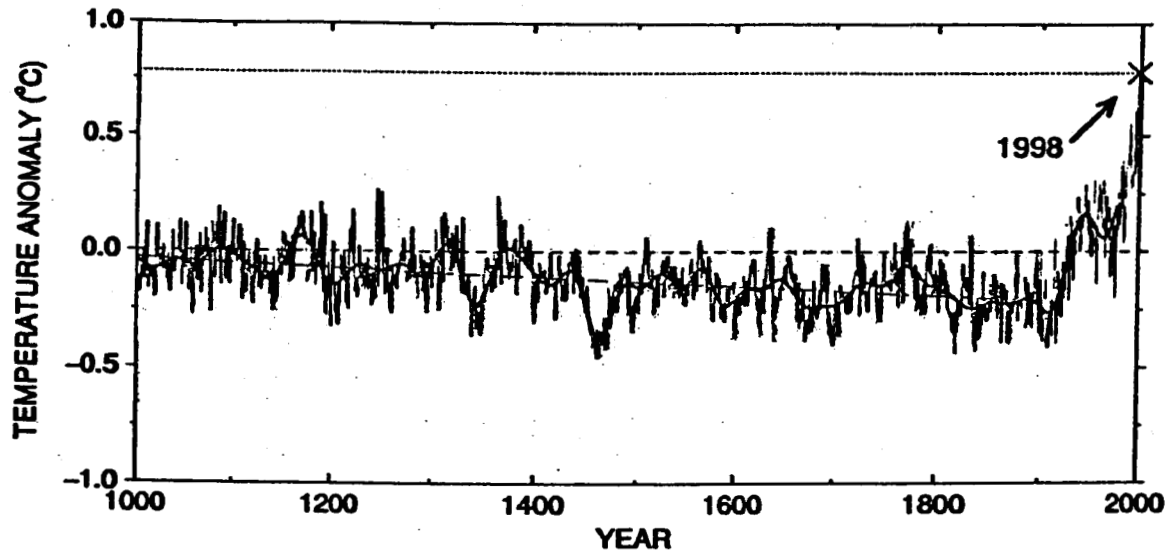
NOTE: The closed circles represent the data used in the study, compared with the data excluded (open circles). The "human fingerprint" Santer et al. claimed in their study was largely a result of the years chosen.

Michaels and Balling 2000,
The Satanic Gases, Cato Inst. Washington DC

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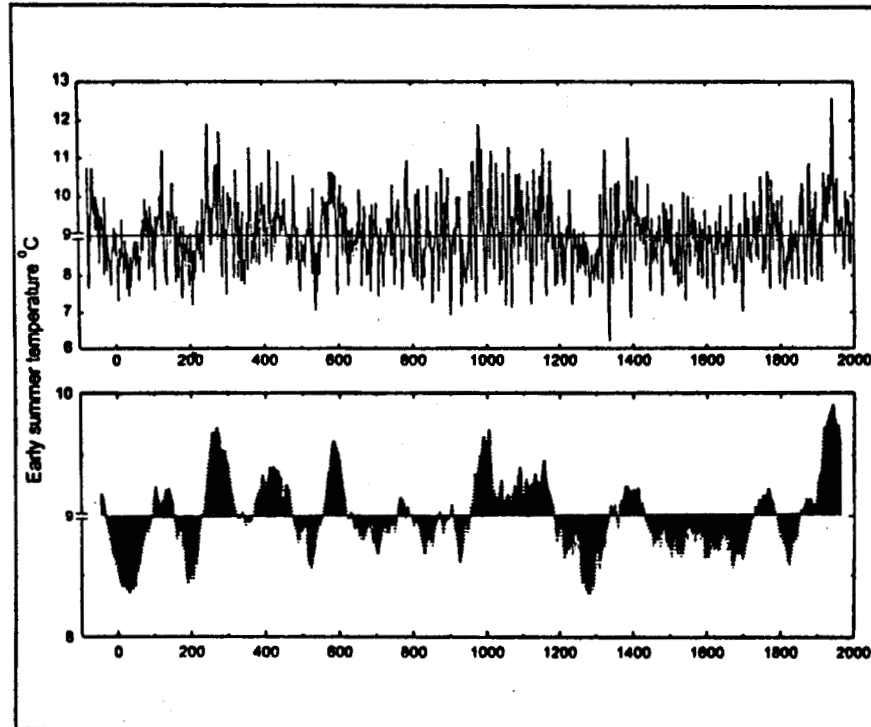
Click the 'Go to Previous' arrow: ◀ in Acrobat Reader to return to the text .
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FIGURE 17: RECONSTRUCTED NORTHERN HEMISPHERE TREND



Mann, Bradley & Hughes 1999, *Geophysical Research Letters* v 26

FIGURE 18: RUSSIAN HIGH ARCTIC TREE-RING RECORD



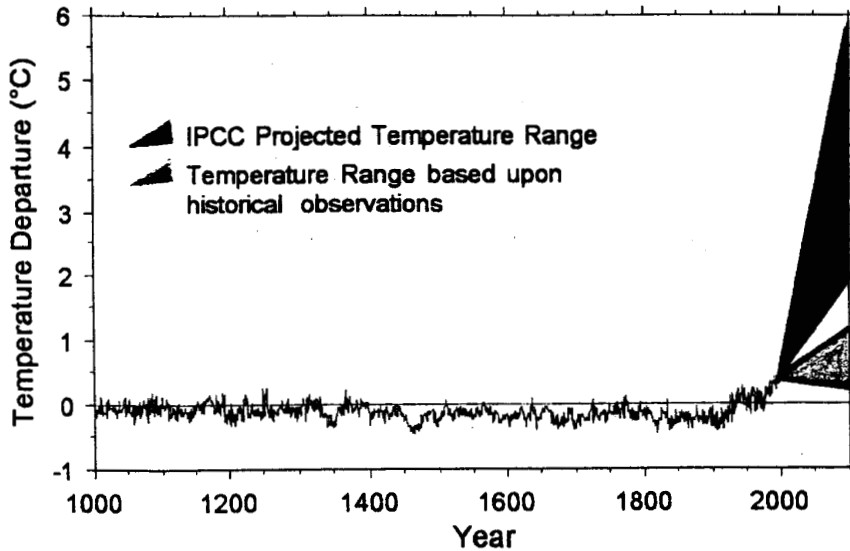
Reconstructed early summer temperature history in northern Siberia (top) and a 57-year smoothed version of the same data (bottom) show the warming in the first half of the 20th century is not unprecedented: In fact, it has natural counterparts in past centuries.

Naurzbaev and Vaganov 2000, *Jour Geophys Res* v 105 D6

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2100 •

FIGURE 19



The 1,000-year temperature history, as culled from proxy records and observations, shows a 900-year decline in temperature that does not reverse until the 20th century. The small variation in the historic record is evidence of the extreme range of the IPCC warming scenarios for the next 100 years (shaded region). If we use the past as prologue to our future, the range is much less alarming.

<http://www.greeningearthsociety.org/Articles/2001/vca7.htm>

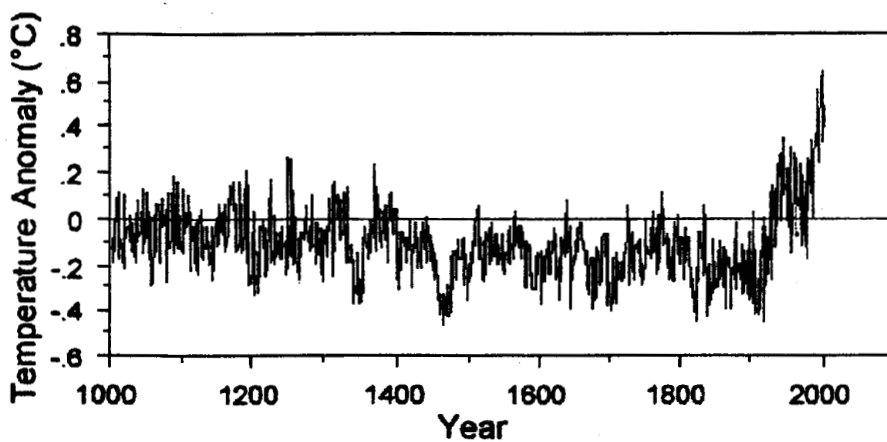


FIGURE 20

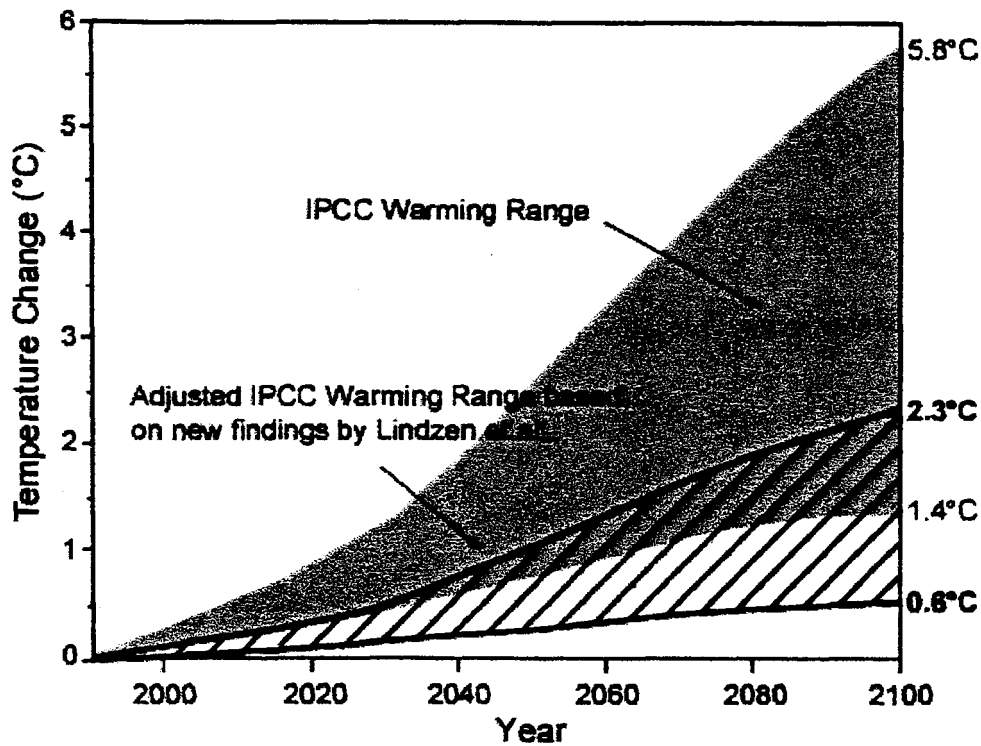
Mann's famous "hockey stick" graph showing reconstructed temperatures for the past 1,000 years. The IPCC's scenario of the 5.8°C warming by 2100 is off the charts. Literally. That's it up there near the right-hand corner of this page.

<http://www.greeningearthsociety.org/climate/v6n12/hot1.htm>

IPPC's Third Assessment Report: Too Much 'Imagination Block'—Figures

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FIGURE 21: IPPC'S WARMING PREDICTIONS MODIFIED



The range of warming by the year 2100, as envisioned by the IPCC (shaded), is bounded by the 1.4°C and 5.8°C. The recent findings of Lindzen and colleagues indicate that this range should be only 0.6°C to 2.3°C (cross-hatched), a far cry from the doom and gloom we have been hearing so much about.

http://www.greeningearthsociety.org/climate/previous_issues/vol6/v6n13/feature1.htm