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COAG Bushfire Inquiry
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4 December, 2003

Dear Sirs,

COAG INQUIRY ON BUSHFIRE MITIGATION AND MANAGEMENT
SUBMISSION BY BOB FOSTER
REGARDING LONG TERM CLIMATE CONDITIONS

SUMMARY

My submission refutes, on both scientific and economic grounds, CSIRO's projection that "by 2070, annual average temperatures are increased by 1.0 to 6.0 °C over most of Australia". This assertion has zero value as a guide to Australian policymakers – or to this Inquiry.

Scientific: Almost no-one disputes that the Sun was principal driver of Earth's ever-changing climate prior to 1900. But the quite-implausible belief that the Sun resigned from the climate-change game in the 20th Century, is a prerequisite for CSIRO's projections; these assume that human actions drive global climate – now, and for the century ahead. In reality, there is little doubt that solar/planetary/galactic influences both did and do dictate climate-change.

Economic: CSIRO's range for 2070 is built on a naive acceptance of the 1990-2100 warming projections published by the Intergovernmental Panel on Climate Change. IPCC chose quite outlandish economic assumptions to attain its globally-averaged surface temperature increase of 1.4 to 5.8 °C by 2100; and CSIRO adopted them. Thus, its 'high-end' projection is under-pinned by IPCC's assumption of an almost-unimaginable increase of real per-capita GDP in the LDCs of 65 times between 1990 and 2100; and its 'low-end' assumes a lower, but still implausibly-high, rate of Third World economic growth. CSIRO's 1.0-6.0 °C by 2070 is no "range" – as can be seen from the selective downscaling to individual countries listed below:

ECONOMIC BASIS FOR IPCC'S HIGHEST & LOWEST EMISSIONS SCENARIOS

(National GDP in thousands of 1990 US dollars per-capita - using market exchange rates)

	<u>1990 actual</u>	<u>2100 high-end (A1)</u>	<u>2100 low-end (B1)</u>
United States	23.2	114	79
Australia	17.0	61	55
Argentina	6.5	152	90
South Africa	4.0	470	364
China (PRC)	1.9	78	39
India	1.3	36	32

(Source: Ian Castles at www.ipa.org.au/pubs/special/climate/castlespaper)

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1. CSIRO'S TEMPERATURE PROJECTIONS FOR AUSTRALIA

CSIRO's website www.dar.csiro.au/impacts/future warns citizens that: "by 2070, annual average temperatures are increased by 1.0 to 6.0 °C over most of Australia" ... because of human-caused greenhouse gas emissions. For the "inland", the last (1996) report gave 'only' 0.7-3.8 °C; but CSIRO's new (8 May 2001) projection is vastly increased to 1.0-6.8 °C.

Subsequently, CSIRO distributed a poster entitled "Future Climate Change in Australia". It tells of a "greater fire risk for forests and urban areas" in Southern South Australia, Tasmania, Victoria and Eastern New South Wales. Under "Climate Data", the poster explains:

- * Values for **Now** come from the Bureau of Meteorology
www.bom.gov.au/climate/averages
- * Values for **2030** and **2070** come from CSIRO's assessment of nine climate models driven by a range of projected increases in greenhouse gases
www.dar.csiro.au/publications/projections2001.pdf

Boxes in the poster tell us that "Dec-Feb days over 35 °C" in Sydney, Melbourne and Adelaide now number 2, 8 and 10 respectively; and by 2070, they will rise to a range of 3-11, 10-20 and 14-28. I promise I am not making this up: it also shows my birth-place, Darwin, going from one Dec-Feb day per year over 35 °C on average now, to a whopping 5-79 days by 2070!

CSIRO's catastrophism could turn out to be quite right, of course; but it has absolutely no way of knowing that now. Wisely, CSIRO includes a caveat:

"This poster is based on results from computer models that involve simplifications of biophysical processes that are not fully understood. Accordingly, no responsibility will be accepted by CSIRO for the accuracy of the assessments inferred from this poster or actions in reliance on this information".

2. ALL THE WAY WITH IPCC

Why then did CSIRO (in 2001) project such an increase in the high-end of its warming range for Australia (*cf* 1996)? The short answer is: because it adopted, as starting point for its regional modelling, the new global averages projected by the United-Nations-sponsored Intergovernmental Panel on Climate Change. Between its Second (1996) and Third (2001) Assessment Reports, IPCC increased the high-end of its range for 2100 from 3.5 to 5.8 °C. In response, CSIRO increased its high-end global rise for 2070 on a pro-rata basis, from 2.1 to 4.0 °C.

Misleadingly, CSIRO explains away the big jump as follows:

"This faster rate of warming was mainly due to changes in the emissions of sulphate aerosols between the two sets of scenarios. Emissions of sulphate aerosols, which have a cooling effect on climate, were projected to increase strongly in the (IPCC 1996) scenarios, but these increases were much reduced in the (IPCC 2001) scenarios."

This explanation is implausible. The first draft of IPCC's "Climate Change 2001: the scientific basis", prepared way back in 1999, already included the changed assumptions for cooling aerosols, and the high-end projection for 2100 rose then only from 3.5 to 4.0 °C.

In any case, the aerosol explanation is contradicted by the observed pattern of warming. Roughly 90% of these short-lived aerosols are emitted in the Northern Hemisphere – where most fossil fuels are burned. But most of the warming to date is in the same hemisphere. (Indeed, Australia emits negligible ‘cooling’ sulphates - whose future elimination might otherwise have enabled IPCC’s supposed global boost to be shared by CSIRO’s projected regional warming.)

IPCC’s global 5.8 °C ‘high-end’ number did not surface until the final draft of October 2000 – after review by government representatives. The key *post-science* changes (here relying largely on Vincent Gray’s book “The Greenhouse Delusion”) appear to be:

- * Addition of a high-end scenario (A1F1) which incorporates an extremely high use of fossil fuels;
- * Substitution of the single model (incorporating IPCC’s ‘best-estimate’ for the sensitivity of climate to increasing CO₂ concentration) by a suite of seven models having a wide range of sensitivities - including one with a particularly high sensitivity.

And also, at the ‘low-end’:

- * Cosmetic “rounding up” of the calculated number from 1.0 to 1.4 °C, thus serving to lift it clear of the 1.0 °C low-end for the previous (1996) range.

IPCC’s explanation, repeated by CSIRO, that the jump from 1.0-3.5 °C to 1.4-5.8 °C results from assuming lower sulphur dioxide emissions in the future, doesn’t wash.

3. SRES BASIS FOR IPCC’S PROJECTIONS

“Climate Change 2001: the scientific basis”, the Working Group 1 contribution to IPCC’s *Third Assessment Report*, has these words in its *Summary for Policymakers*:

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

The first bullet-point under this emboldened heading continues:

“The globally averaged surface temperature is projected to increase by 1.4 to 5.8 °C over the period 1990 to 2100. These results are for the full range of 35 SRES scenarios based on a number of climate models.”

But caution is needed. The lay reader may not notice that IPCC is talking of “projections” (not predictions) of increasing temperature; and that these projections are underpinned by “scenarios” (not forecasts) for future greenhouse gas emissions. The scenarios are based in turn on several alternative “storylines” describing the world’s future economic and social development.

The outcome is no more than an un-weighted assortment of ‘what-ifs’, without any attribution of individual probabilities (all outcomes, even including the extremes, are plausible i.e. “all should be considered equally sound”), or any claim of comprehensiveness. IPCC never says its numbers are a “range” *per se*. (Yet, when CSIRO tells us it expects Darwin’s annual days over 35 °C to rise from one now to “42±37” in 2070, this looks like a range.)

The origin of the economic and social assumptions underlying IPCC’s six marker “storylines” is the *Special Report on Emissions Scenarios* (SRES). The assumptions therein give rise to the 1.4 (or 1.0) and 5.8 °C projections, and to intermediate projections not discussed here.

4. SRES'S ECONOMIC/SOCIAL NEXUS

4.1 IPCC/IIASA growth projections.

The lead author of SRES was Professor Nebojsa Nakicenovic from the International Institute of Applied Systems Analysis (IIASA), at Laxenburg in Austria.

SRES's A1 "marker" storyline, setting the high end of IPCC's range (5.8 °C by 2100), achieves a notable catch-up of living standards in the LDCs to those of the developed world. The result is a wonderful world where nearly everyone is rich. There is absolutely nothing wrong with that, of course; but, it does require an almost-unimaginable increase in Third World per-capita GDP. Hence, the driver for A1 is not rational economics; instead, it appears to be a yearning in the hearts of the IIASA/SRES economists for world-wide social equity.

The SRES analysts calculated that, back in 1990, developed nations had an average per-capita GDP some 16.7 times that of the LDCs. Their laudable wish that the ratio be reduced to x1.8, demanded a projected increase of GDP in the 'have-not' regions by an incredible 65 times¹ between 1990 and 2100 – so high because, obviously, GDP in the 'have' nations keeps growing as well. (Remember, Japan barely achieved x20 per-capita growth in the 20th Century. No others came close.)

The A1 storyline invokes phenomenal growth in Third World economic output². In the US, per-capita 1990 GDP was \$23,000 but it was only \$4,000 in South Africa. In 2100 (still in terms of 1990 US dollars), A1 puts it at \$114,000 in the US and \$470,000 in South Africa. Australia fares even worse than the US in comparison to a rampant Third World; and by 2100 its per-capita GDP will be surpassed by Afghanistan, Algeria and Argentina (see Attachment for details).

The low end of IPCC's range (1.4 °C by 2100) is based on the slightly less-fantastic, but still implausible, B1 storyline (also see Attachment) - where "the emphasis is on global solutions to economic, social and environmental sustainability, including improved equity".

1. Ian Castles (former Australian Statistician, and now Visiting Fellow at the National Centre for Development Studies at the Australian National University in Canberra) finds that the SRES analysts used market exchange rates to compare inter-country GDPs in 1990. In his expert opinion, they should have used purchasing power parities. Correct analysis would have revealed that the 1990 gap was not 16.7 times but x6.2. Thus the GDP increase necessary to shrink the gap to x1.8 would have been x24.5 rather than x65. If IPCC should surprise us by re-working its flawed economics, policymakers may still have to wait until its Fourth Assessment Report (due in 2007) for the results. In the interim, I rely on IPCC's current numbers.

2. IPCC's 'catch-up' storylines make extraordinary reading. First, a **caveat**: for purposes of approval/publication, IPCC divided the world into four large economic units only. Thus, its down-scaling to country-level is unofficial; and furthermore, web access to these numbers now has been withdrawn. But, the country-by-country projections are still real in the sense that totals for the four larger units comprise them. Individually approved or not, reducing one country's quite incredible GDP growth would imply increasing that for another.

4.2 WEC/IIASA growth projections.

Professor Nakicenovic and IIASA have tilled this ground before. I here quote from one of Ian Castles' several critical analyses of the SRES work; in this case, "Forecasting global output and emissions", presented at the Institute of Public Affairs *Climate Change Conference* in Melbourne on 28 February 2003:

"The extreme optimism of the growth assumptions in most of the scenarios can be illustrated by means of another comparison.

In 1998, IIASA published a study of future energy usage and options in association with the World Energy Council (WEC), under the title *Global Energy Perspectives*. Professor Nakicenovic was the lead editor of the book."

And

"There is, however, a striking difference. **All** of the IIASA/IPCC scenarios in the A1 family – which yield the highest cumulative emissions across the century – and the B1 family – which yield the lowest cumulative emissions – assume much higher rates of growth in GDP between 1990 and 2050 (the endpoint of the detailed IIASA/WEC projections) than **any** of the IIASA/WEC scenarios."

And further

"It is difficult to understand why the range of assumed rates of growth in GDP in scenarios developed for the purpose of projecting emissions should be so much higher than the range assumed for the purpose of projecting energy use and alternatives. In particular, there is no obvious reason to believe that a scenario that assumes much faster growth than the "ambitiously high rates of growth" postulated in the IIASA/WEC Case A should be accepted as marking the lower bound of possible outcomes in the IPCC context. Yet this is what governments and IPCC scientists appear to have done."

Might I add "CSIRO" here? Hard to imagine, I know; but CSIRO appears to have taken IPCC's economic modelling on trust. Crucially, it did not obtain corroboration from Australians expert in that field – although, according to Castles, none of the "53 authors and 75 reviewers" for the SRES projections is Australia-based. If it comes out of a model, it must be right?

5. IPCC'S PROJECTED RANGE OF CO₂ CONCENTRATIONS

5.1 High-end scenario

The A1F1 (high-end) scenario has the extreme economic growth of the A1 storyline sustained to the maximum degree with coal-derived (i.e. high carbon-intensity) energy in order to achieve the maximum projection of greenhouse gas emissions.

Global CO₂ emissions from fossil-fuel use (plus industrial processes) were about 6.1 billion tonnes in 1990, on a contained-carbon basis. Coal-intensive A1F1 has them rising steeply to 24 BT in 2050 and 30 BT in 2100. Historical carbon emissions peaked at 1.23 tonnes per-capita in 1979, and fell slowly to 1.11 tonnes by 1999. A1F1 has them at over 4 tonnes by 2100; and this scenario assumes cumulative coal use by then reaching well beyond the exhaustion of currently-known reserves. A1F1 has atmospheric CO₂ concentration building up to 970 ppm in 2100 (only achieved by assuming a very long effective mean residence time for atmospheric CO₂).

But the writing is on the wall for A1F1 and its 970 ppm, because it had world coal consumption growing 31% in the decade between 1990 and 2000. The *BP Statistical Review of World Energy* shows that it grew a very much more-plausible 5.6% in the 12 years to 2002.

5.2 History of atmospheric CO₂ concentration

Atmospheric CO₂ concentration at Mauna Loa has been recorded ever since 1958, when it was 315 ppm. By 1990, it had attained 354 ppm; and in 2002, an annual increase of 2 ppm brought it to 373 ppm. Over the last 44 years, the average increase was 1.3 ppm/year from all causes, both natural and anthropogenic. But to attain 970 ppm by 2100, an average annual increase of 6 ppm/year is needed from now on - right through the century ahead.

Since the 18th Century, rebound from the depths of the Little Ice Age, and advent (say, 1750) of the industrial revolution, have coincided with an atmospheric CO₂ concentration increase from some 280 to the present-day 373 ppm. At least since detailed records began in 1958, it appears that Pacific sea-surface temperature has been a key factor. Following the Great Pacific Climate Shift of 1976/77, the rate of increase stepped up to a new plateau – albeit still averaging well below 2 ppm/year - with a dip after the Mt Pinatubo eruption, and a spike coincident with the Kalimantan peat fires. Crucially, there is no apparent acceleration in the current rate of increase. The projected concentration of 970 ppm by 2100 appears unrealistic.

5.3 Low-end scenario

The low-end B1 marker storyline still assumes implausibly high economic growth in the Third World (see Attachment) – although not as high as A1. We are told that “the central elements of the B1 future are a high level of environmental and social consciousness combined with a more globally coherent approach to a more sustainable development”. The resulting economic projections are then powered between 1990 and 2100 to the maximum degree with non-fossil forms of energy - to achieve the substantially-reduced greenhouse gas emissions of the low-end BIT MESSAGE scenario. The outcome is an atmospheric CO₂ concentration in 2100 of a relatively modest 540 ppm.

5.4 How NOT to achieve a range

IPCC has achieved its ‘range’ by assuming large or small contributions by coal to the satisfaction of energy demand in its best of all possible worlds. It records global coal production as being 84 exajoules in its 1990 base-year (about 3.3 billion tonnes on a hard coal heating-equivalent basis), rising to 600 eJ in the coal-powered A1F1 scenario, and falling to 40 eJ in the “more sustainable” B1 scenario-family.

But, how can two implausibly-high projections of Third World economic growth provide bounds to the plausible range of CO₂ emissions? They can’t, of course.

Crucially, no believable level of future economic growth has had applied to its decarbonisation initiatives such as those which dominate the B1 family. Instead, both ends of the ‘range’ follow directly from the presumed achievement of a large measure of world social equity. The range of CO₂ concentrations projected for 2100 (540-970 ppm) has been shifted upward from that which might appear plausible - based on yearnings rather than expectations.

6. IPCC'S PROJECTED 'RANGE' OF TEMPERATURE INCREASES

IPCC's outcomes stem from six storylines containing demographic and economic projections, leading to 35 scenarios for human-caused greenhouse gas emissions and onward to atmospheric CO₂ concentrations.

The result is 245 temperature projections from runs in seven (CSIRO says nine) numerical models covering a wide range of sensitivities. Here, IPCC has given us the key to its Black Box; all we need is graph-paper. The *Summary for Policymakers* of "Climate Change 2001: the scientific basis" tells us that:

"Complex physically based climate models are the main tool for projecting future climate change. In order to explore the full range of scenarios, these are complemented by simple climate models calibrated to yield an equivalent response in temperature ... to complex climate models. These projections are obtained using a simple climate model whose climate sensitivity ... (is) calibrated to each of seven complex climate models. The climate sensitivity used in the simple model ranges from 1.7 to 4.2 °C which is comparable to the commonly accepted range of 1.5 to 4.5 °C."

In this context, "sensitivity" is: sensitivity to a doubling of atmospheric CO₂ concentration.

Take the high-end case first. We now have three points on a graph (but not a straight line on natural graph-paper). The 1990 concentration (354 ppm) gives us our zero, 708 ppm gives us a warming of 4.2 °C, and 1416 ppm brings the warming up to 8.4 °C. (This is a very simple model, remember.) When we mark in 970 ppm on the graph, we expect to read off 5.8 °C. Actually, I got 6.0 °C; a bit puzzling, perhaps - but less than 5% too high.

The low-end case is different. Zero is still 354 ppm, of course; but 708 ppm gives 1.7 °C, and a further doubling brings us to 3.4 °C. However, when we mark in 540 ppm, we read off 1.0 not 1.4 °C of warming – a shortfall of nearly 30%. It turns out that this case is not only based on implausibly-high per-capita GDP growth; the result has been fudged to make it higher.

CSIRO's projections follow on directly from the deeply-flawed economic modelling done by IPCC. I therefore conclude that CSIRO's range of warming for most of Australia (of 1.0 to 6.0 °C by 2070) is of zero value as a guide to Australia's policymakers.

But another and different flaw also underlies the model-based projections of IPCC, and hence of CSIRO. This is the assumption that human-caused greenhouse gas emissions are the principal driver of 20th (and 21st) Century climate. The remainder of my submission deals with this scientific issue.

7. DID HUMANS CAUSE 20TH CENTURY CLIMATE CHANGE?

7.1 Yes! Submission by ANU's Research School of Earth Sciences

The dominant climate-change paradigm is clearly enunciated in a submission of 1 September 2000, by the Australian National University's Research School of Earth Sciences to the (Federal Parliamentary) Joint Standing Committee on Treaties for its Inquiry into the Kyoto Protocol. (So far as I know, the report has never been handed down.) The six signatories were Dr. M. Bird, Prof. J.M.A. Chappell, Dr. M. Gagan, Prof. D.H. Green, Prof. R. Grün and Prof. K. Lambeck.

The last paragraph of the submission's "Concluding Statement" says it all:

"The Research School of Earth Sciences devotes considerable resources of manpower and facilities to the measurement and understanding of global change, including climate change and the carbon cycle. From the 'authority' of our published and unpublished research at RSES on natural variability of climate, on the carbon cycle, on past sea-levels and on past fauna and flora, we are of the firm view that 20th Century global warming and sea-level rise are observed, and on scientific grounds, attributable to changes in the Earth's atmospheric composition caused by human activities."

The six signatories really do believe that in 1900 the Sun relinquished its time-honoured role as principal driver of Earth's ever-changing climate; of that there can be no doubt. Apparently, we have taken over the job ourselves.

7.2 Observed 20th Century warming is in two tranches

IPCC's *Summary for Policymakers* shows us a graph (Figure 1a) of "Variations of the Earth's surface temperature for the past 140 years". Under the graph, it says that over the last 100 years, "the best estimate is that the global average surface temperature has increased by 0.6 ± 0.2 °C". What it doesn't say is that this graph of global temperature correlates very poorly indeed with the consumption of fossil fuels said to be its driver.

The observed warming is in two roughly equal tranches:

* From early in the century to about 1945;

And (separated by an interval of slight cooling);

* From 1976/77 to the present.

We all know the 20th Century energy story. Fossil fuel consumption was about 1.5 billion tonnes in 1900, and rose only slowly to some 4 billion tonnes by the mid 1940s. But then, it soared in virtually monotonic fashion - reaching some 13 billion tonnes per year by 2000. The warming in the first half of the Century anticipated the fuel use which was its cause!

7.3 No! Criticism from the Russian Federation

This puzzle has not gone un-noticed. When opening the World Climate Change Conference in Moscow on 29 September 2003, President Putin said (of Kyoto Protocol ratification): "The Government is thoroughly considering and studying this issue ... and, of course, it will take into account the national interests of the Russian Federation." Presidential science adviser Yuri Izrael provided some clarification by adding that: "... all the evidence seems to support the general conclusions that the Kyoto Protocol is overly expensive, ineffective and based on bad science".

On the last day (3 October), presidential economic adviser, Andrei Illarionov, delivered an assault on the scientific underpinnings of the Protocol. In particular, he noted that 20th Century climate change could not be correlated with fossil-fuel use:

"... from the mid 1970s to 2000 - it was possible to speak about some link between the emission of anthropogenic carbon dioxide with a rise in temperature; here there seems to be a certain similarity observed although one cannot say whether there is a link or not, if there is a cause-effect connection or not."

And

“As for the period from the middle of the 1940s to the middle of the 1970s, it remains a big mystery because anyone who knows the history of mankind since the middle of the 20th century knows that it was a period, that it was a golden period ... of the highest economic growth of the world economy, and it was an era of cheap oil, when oil, coal and gas were extracted and burned at an incredible rate. During these 30 years the extraction and consumption of oil increased six-fold. And we can only imagine how much carbon dioxide emissions increased.”

And further

“... in the period from 1913 to 1944-1945, a period when two world wars, the Great Depression, several global economic crises occurred, a period when the biggest portion of the world economy was stagnating, carbon dioxide emissions caused by human factors increased very slowly. At the same time, now the temperature is growing as fast as it did in the last 25 years.”

The scientific monopoly of those who own the paradigm of human-caused global warming (such as CSIRO and ANU's RSES, in Australia) is over. The correlation between global warming and fossil-fuel consumption during the 20th century was tenuous, at best. It is much more likely that the Sun didn't resign from the climate change game in 1900, at all. Almost certainly, it is still solar/planetary/galactic influences which drive climate.

8. ALTERNATIVE HYPOTHESIS FOR 20TH CENTURY CLIMATE CHANGE

8.1 The contrarian view

Contrarians like me are convinced of the continuance of a solar-driven climate right through the 20th Century. The evidence comprises both measurements, and derivations from proxies where direct observation is infeasible. (While good correlation between data-sets is no proof, it can better support a hypothesis than would poor correlation.)

Crucially, the “firm view that 20th Century global warming (is) attributable to changes in the Earth's atmospheric composition caused by human activities” lacks the support of correlations between observations and/or proxies. (Its support largely derives from model-based analyses.) In my ‘firm view’, the forcefully-expressed hypothesis of the ANU Research School of Earth Sciences is almost certainly wrong.

8.2 ‘Hockeystick’ as evidence

However, Figure 1b of IPCC's *Summary for Policymakers*, showing “Variations of the Earth's surface temperature for the past 1000 years”, does appear to support the ANU Research School's experts. This graph (the famous/infamous ‘Mann hockeystick’) represents only the Northern Hemisphere, because so little data is available from the South. The explanation under the graph tells us that:

“... variations of the average surface temperature of the Northern Hemisphere have been reconstructed from ‘proxy’ data. ... The rate and duration of warming of the 20th century has been much greater than in any of the previous nine centuries. Similarly, it is likely that the 1990s have been the warmest decade and 1998 the warmest year of the millennium.”

What we see in the ‘Hockeystick’ is a long, somewhat-wavy, ‘handle’ declining slowly across nine centuries to a low-point at 1900. Then, it makes an abrupt upward turn as the 20th Century ‘blade’ heads skyward. Indeed, it does appear that the 1990s were the warmest decade, and 1998 the warmest year, of the millennium.

There is more to this influential picture than meets the eye. The largest contributor to the 900-year proxy record is tree-rings from high latitudes and high altitudes in North America. But the record provided for the 1990s decade, as also for the 1998 year, has nothing at all to do with tree rings; it is based instead on direct measurements by thermometer.

The trees used in the comparison would have grown in the growing season - of about six weeks centred on June. However, the thermometer record shows that 20th Century warming occurred predominantly in winter – a time when the trees whose rings were analysed, didn’t grow.

IPCC has compared apples with oranges here - thus committing the scientific equivalent of a schoolboy howler. To claim that it is likely 1998 was “the warmest year of the millennium” on the basis of this kind of evidence, sounds more like scaremongering than science to me.

8.3 Solar variability

A proxy for variations in solar activity is provided by sunspots. European observatories have recorded sunspot numbers back to around 1600; and it has been long-known that the Maunder (sunspot) Minimum coincided with the coldest episode of the Little Ice Age at about 1650-1710. Warming since then has correlated well with strengthening solar activity.

Over the past few years, another proxy has been developed to extend the record of solar activity much further into the past – production in the atmosphere of the cosmogenic isotopes ¹⁴C and ¹⁰Be. These nuclides (preserved in tree-rings, ice-cores and cave-deposits) are an indicator of solar magnetic activity - greater abundance means a quieter Sun - which appears to vary much in line with solar heat output. Both insolation and magnetic flux appear to impact on climate; but the extent to which the Sun’s magnetic field shields Earth from bombardment by galactic cosmic rays is now accepted by some as the more-important solar control on our climate.

It is already known that there is a good general relationship between solar activity (based on the ¹⁰Be proxy) and climate over the past 100,000 years; and analyses from the northern Atlantic and northern Pacific regions over the past 10,000 years, during the current (Holocene) Interglacial, display a correlation between solar magnetic activity and cyclic climate-change at a variable period of about 1,500 years.

More-detailed studies^{3,4} are becoming available.

3. Neff, U. *et al* 2001, “Strong coherence between solar variability and the monsoon in Oman between 9 and 6 kyr ago”, *Nature* v 411 pp 290-3.

4. Usoskin, Ilya G. 2003, “A millennium scale sunspot number reconstruction: evidence for an unusually active Sun since the 1940’s”, *Physical Review Letters* (in press).

In the Djebel Akhdar range (northern Oman), the Indian Ocean monsoon is climate. Comparison of the $\delta^{18}\text{O}$ record from stalagmites in caves on the djebel (proxy for varying tropical circulation and monsoonal rainfall) with the well-known $\Delta^{14}\text{C}$ record from tree-rings (which largely reflects changes in solar activity), by Neff *et al* (2001) reveals a striking correlation over the 3,000-year period studied. Indeed, for the 400 years analysed in greater detail, the proxies for climate and solar activity march in virtual lockstep. Implausibly, IPCC's numerical-modellers have climate marching in lockstep with human-caused changes to the composition of the atmosphere.

Usoskin *et al* (2003) reconstruct sunspot numbers (an established proxy for solar activity) back, far beyond the long-recognised increase in solar activity since the depths of the Little Ice Age at the Maunder Minimum. The crucial finding⁵ of the study is that the Sun was far more active in the second half of the 20th Century than at any time since this record began— even more-so than in the Mediaeval Warm Period (AD850 to some time after 1200). Thus, there is no necessity to invoke human-caused changes to the composition of the atmosphere as the cause of global warming in the 20th Century.

9. INERTIAL INFLUENCES ON 20TH CENTURY CLIMATE CHANGE

9.1 Cyclic climate since AD 1700

Global climate is cyclic (warmer/cooler) at many time-scales – although IPCC's modellers admit only to warming in the future. Since the Dalton Minimum, the final cold-snap of the Little Ice Age from 1800 (the last of the Great Frost Fairs on the Thames was in 1813/14), we have experienced rebound in the 1820s and warming peaks in the 1870s, 1930s and 1990s.

These warmings are overprinted on a longer warming trend which goes back to the Maunder Minimum, when sunspot numbers were virtually zero. During the Great Winter of 1683/4, when 11 inches of ice formed on the River, diarist John Evelyn wrote:

“Streetes of Boothes were set up upon the Thames, which were like a Citty or Continental faire, all sorts of Trades and shops furnished, and full of Commodities, even to a Printing presse ...”

The long-running (for at least 200,000 years) ca. 1500-year cold/warm cycle, of which the Roman Empire Warm Period, Dark Ages, Mediaeval Warm Period and Little Ice Age are the latest manifestations, is directly linked to solar influences. But the overprinted 50/80-year cycle of global temperatures appears related in the first instance to inertial factors, as evidenced by cyclic changes in length-of-day which display a strikingly similar period; and the same period applies to the cycle of change in the movement of atmospheric and oceanic mass – and hence in heat transportation and climate. Again, the Sun (and giant planets) may be involved, although we don't yet know quite how – but there is no 'greenhouse effect' signature in evidence

5. The abstract of this not-yet-published paper is:

“The extension of the sunspot number series backward in time is of considerable interest for dynamo theory, solar, stellar, and climate research. We have used records of the ^{10}Be concentration in polar ice to reconstruct the average sunspot activity level for the period between the year 850 to the present. Our method uses physical models for processes connecting the ^{10}Be concentration with the sunspot number. The reconstruction shows reliably that the period of high solar activity during the last 60 years is unique throughout the past 1150 years. This nearly triples the time interval for which such a statement could be made previously.”

9.2 Climate Shift of 1976/77

The Great Pacific Climate Shift was the climatic event of the century, with a widespread physical and biological impact extending far beyond the Pacific. The Shift (1976/77) coincided with an abrupt reduction in the upwelling of cold water in the eastern Pacific, as recorded by the Pacific Decadal Oscillation Index - which recognises episodes of warmer sea-surface temperature (SST) during the 1920s-40s, and again at 1977-98.

Since the early '70s, annual upwelling quantity in the equatorial eastern Pacific has declined from 47 to 35 Sv (where one Sievert equals one million cubic metres per second), with a corresponding increase in SST of 0.8 °C. This is a very large change in oceanic circulation, and hence in oceanic heat transportation. That the change in upwelling was inertia-related is indicated by coincident changes in the rate of change of length-of-day, and in atmospheric angular momentum.

It is hard to see why a virtually monotonic increase in the human-caused atmospheric concentration of greenhouse gases should be considered the most likely cause of the prominent changes in oceanic and atmospheric momentum which were associated with the Shift.

9.3 Short-term El Niño/La Niña changes

El Niño and La Niña are intra-decadal warm/cool events in the same general region (the eastern Pacific) that incurred the longer-duration change introduced by the Great Pacific Climate Shift. These - also upwelling-related - events are mimicked by temperature in the lower troposphere derived from observations (see <http://www.ghcc.msfc.nasa.gov/MSU/msusci.html>) by NASA weather satellites, available since 1979.

The satellite record is crucial to testing the 'human-caused greenhouse effect' hypothesis. Here, increased anthropogenic emissions of greenhouse gases are supposed to cause warming of the lower atmosphere, and some of this extra warmth is subsequently returned to warm the surface. It is this resultant surface warming which is called the "greenhouse effect" – greenhouse gases don't warm the surface directly. However, there appears to have been little warming of the lower atmosphere during the past 24 years; and the simplest conclusion is that most surface warming, at least since 1979, is something other than greenhouse-effect warming.

Furthermore, the shape of the NASA temperature graph for the lower atmosphere shows no correlation with the increase in fossil fuel consumption during that period.

Temperature variation in the lower atmosphere clearly reflects the cold/warm upwelling variations of La Niña and El Niño in the eastern Pacific; although one warm event was partly masked by the El Chichón volcanic eruption in 1983, and another was obscured by the Mount Pinatubo eruption in 1992. The NASA record is unlike any expected response to human-caused changes in atmospheric composition.

What might have caused the intra-decadal upwelling variations in the Pacific? The atmospheric record which mimics them, looks rather like hunting and/or resonance effects – perhaps reflecting momentum exchanges affecting the temperature of the upper ocean. The underlying driver could be (but we don't know, of course) solar/planetary inertial effects.

9.4 Contemporary climatic events

Southern Victoria suffered a cold August/September/October; with traditional stone-fruits reaching the market about three weeks late. Against the trend, November has been relatively warm (and dry), with exceptionally hot days on the 14/15th. Could the November warmth result from the human-caused greenhouse effect? Probably not.

A series of intense solar flares began on about 22 October, with that on 6 November being the most intense ever recorded. Scientists had never witnessed a series of eruptions like this. But a spurt in solar activity should mean increased solar magnetic flux resulting in less-cloudy skies; and the final outcome would be warmer weather. It is much too early to draw conclusions; but even here, solar (or, more correctly, solar/planetary/galactic) influences should be kept in mind. Human-caused interference with the composition of the atmosphere is far from the full story.

CONCLUSIONS

CSIRO warns us that Australia could warm by up to ten times as much by 2070 - from the human-caused greenhouse effect alone - as the global-average warming from all causes over the last 100 years. This wanton catastrophism has no sound basis in either economics or science.

When people tell me that the reason Londoners can no longer roast oxen on the Thames in winter is because of our interference with the composition of the atmosphere, I remind them of the Sun. Solar activity is now much higher than at any time in the last millennium, and very much higher than in the depths of the Little Ice Age. Here is the main cause.

But it is not yet clear *how* solar activity controls climate. A correlation has been established⁶ between small changes in solar irradiation (measured by satellites) and unexpectedly large changes in the temperature of the lower troposphere; and an explanation for the enhanced impact associated with these small insolation changes is emerging⁷. Sun's magnetic output also varies; and because it shields Earth from galactic cosmic rays and their nucleation effects in the atmosphere, greater magnetic flux means less (cooling) low-altitude clouds.

There are two separate manifestations of solar activity – irradiance and magnetic flux. But which has the greater influence on climate, is not a crucial issue for planners.

On the other hand, new work⁸ proposes that the solar torque cycle (driven by the giant planets) controls solar activity; thus, climatic events (e.g. El Niño) become predictable. It is only a small step to accept that the same inertial influences act directly on Earth – thereby explaining observed changes in the rate-of-change of length-of-day, and associated momentum-related events such as the Great Pacific Climate Shift. The solar system is not chaotic; and inertial influences could be calculated. Climate may well be predictable – but not when using CSIRO's methodology.

6. Douglass, David H., and B. David Clader 2002, "Climate sensitivity of the Earth to solar irradiance", *Geophysical Research Letters* v 29 no 16, pp 33-1 to 33-4.

7. Carslaw, K.S., R.G. Harrison and J. Kirkby 2002, "Cosmic rays, clouds and climate", *Science* v 298 pp 1732-7.

8. Search "Landscheidt" at www.john-daly.com for Theodor Landscheidt's innovative work.

Attachment

GDP IN YEAR 2100 FOR IPCC'S HIGHEST & LOWEST EMISSIONS SCENARIOS

(Thousands of 1990 US dollars per-capita calculated on a market-exchange-rate basis)

	<u>High-end (A1) Marker</u>	<u>Low-end (B1) Marker</u>
South Korea	653	201
South Africa*	470	364
Malaysia	208	64
Italy	177	110
Russian Federation	170	103
Germany	168	105
Thailand	165	51
Argentina*	152	90
Japan	132	93
United States*	114	79
Brazil	112	68
Mexico	104	62
Canada	88	73
Zimbabwe	87	68
Cameroon	82	64
China (PRC)*	78	39
Afghanistan	78	69
Algeria	75	158
Venezuela	71	42
Indonesia	68	21
Philippines	66	20
Australia*	61	55
Peru	38	23
India*	36	32
Pakistan	25	23
Bangladesh	23	21
Turkey	12	87

1990 GDP in US\$ thousands per-capita was: US 23.2, Australia 17.0, Argentina 6.5, South Africa 4.0, PRC 1.9 and India 1.3. These estimates are from Angus Maddison's book *The World Economy: A Millennial Perspective* (OECD 2001).

Source: Down-loaded from SRES website <http://sres.ciesin.columbia.edu/tgcia/> by Ian Castles. These numbers still are available at www.ipa.org.au/pubs/special/climate/castlespaper although the IPCC Task Group on Climate Impacts Assessment has withdrawn public access to its site.

Warning: The per-capita GDP data for individual countries (above) has been down-scaled by SRES from collective totals for the four regions comprising the world. However, it is only GDP for the regions which has IPCC approval; and therefore, the individual-country numbers are without official standing. It seems obvious, though, that any country for which GDP might be revised down in future must then be matched by revising another country up. Otherwise the already-approved regional totals would surely change.