

Ian Plimer's 'Heaven + Earth' — Checking the Claims

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Overview

Ian Plimer's book, *Heaven + Earth — Global Warming: The Missing Science*, claims to demolish the theory of human-induced global warming due to the release of CO₂ and other greenhouse gases. Overall:

- it has numerous internal inconsistencies;
- in spite of the extensive referencing, key data are unattributed and the content of references is often mis-quoted.

Most importantly, Ian Plimer fails to establish his claim that the human influence on climate can be ignored, relative to natural variations.

Ian Plimer's claim that the human influence on climate can be ignored, relative to natural variations, seems to rest on three main strands of argument:

- a:** the extent of natural variability is larger than considered in 'mainstream' analyses;
- b:** changes in radiative forcing from greenhouse gases have less effect than determined in 'mainstream' analyses;
- c:** the IPCC uses a range of misrepresentations to conceal points **a** and **b**.

Among the many errors made in attempting to establish these claims, are cases where Plimer:

- misrepresents the content of IPCC reports on at least 13 occasions as well as misrepresenting the operation of the IPCC and the authorship of IPCC reports;
- has at least 17 other instances of misrepresenting the content of cited sources;
- has at least 2 graphs where checks show that the original is a plot of something other than what Plimer claims and many others where data are misrepresented;
- has at least 6 cases of misrepresenting data records in addition to some instances (included in the total above) of misrepresenting data from cited source.

Details of these various types of flaw can be obtained via the relevant entries in the index.

A guide to how readers can independently check my claims is given on page 33.

Breadth of Science

In Plimer's public appearances he has made the claim that climate scientists are ignoring geology. This is untrue. Some of the geologists who are important in developing understanding of climate and climate change have been:

- Högbohm – who worked with Arrhenius;
- Eric Sundquist of the USGS (with Sarmiento, resolved carbon budget ambiguity);
- the many geologists who have contributed to the paleo-climate studies that Plimer misrepresents;
- Henry Pollack, a borehole specialist, who has published an excellent book, *Uncertain Science ... Uncertain World*, (CUP), pointing out that uncertainty about climate is much less than the uncertainty surrounding many other important decisions;
- and of course the American Geophysical Union which covers the gamut of Earth sciences – atmospheric, oceanic, solid earth, space sciences and most recently biogeochemistry — has strongly endorsed the reality of human-induced global warming:
http://www.agu.org/outreach/science_policy/positions/climate_change2008.shtml

Point by point

This list has been evolving, in part due to input from colleagues. The items are listed in order of pages in *Heaven + Earth* and the page noted — the item numbering is changing as the document is extended. An index for various topics is given, identifying both the item number and the page in the present document. If you wish to quote items here, quote using the page number in *Heaven + Earth*. Better still, don't quote me at all — use this document as a guide to check it out for yourself, even if you have to resort to buying the book. In cases where colleagues have advised me of flaws in the book, this is acknowledged by noting initials after the particular item. The acknowledgements section below identifies those involved. Material that is underlined is presented as an exact quote from *Heaven + Earth*, except that footnote references have only been retained when they are important for indicating misrepresentation of cited sources. When I refer to 'footnotes' or 'references' this means Plimer's footnotes not mine, unless I explicitly indicate otherwise.¹

1. In spite of Plimer being praised for the extensive referencing, many of the controversial assertions have no supporting citation. These include: the claim that 102 studies found that 78% found earlier periods, lasting at least 50 years, that were warmer than any period in the 20th century [page 86]; frequent claims that the Medieval Warm Period was 2 to 3 degrees warmer than the present (for which some of the cited references do not even address the Medieval period); and the repeated claim that the climate sensitivity is 0.5°C.

¹There are no explicit references to my own footnotes in versions through to 1.8.

2. In his efforts to down-play the extent of warming from CO₂, and exaggerate the relative role of water vapour, Plimer ends up implicitly attributing so much warming to water vapour, that the planetary temperature in the absence of water vapour would be nearer the temperatures of the outer planets. In some cases the numbers given by Plimer are exaggerated to such an extent as to imply that without water vapour, Earth's temperature would be below absolute zero — a physical impossibility. The exaggerations fall into two groups: those that relate to anthropogenic CO₂ and those that relate to total CO₂. In each case, inconsistency arises when the exaggeration in the relative proportions is combined with values for absolute warming.

i: exaggerations concerning anthropogenic CO₂:

The implications of the claim that *CO₂ derived from human activity produces 0.1% of global warming* is analysed in item 81.

ii: exaggerations concerning total CO₂:

The inconsistency in attributing 18°C of warming to total CO₂ [page 366] while stating in the caption of figure 44: *About 98% of the greenhouse effect in the atmosphere is due to water vapour*, is noted in item 55.

3. A large fraction of the graphics are given without any attribution of the sources of the data. Figures 2, 22, 36, 41, 43, 45 are schematics, where a citation is not needed, unless to acknowledge authorship by others. Figures 6, 7, 14, 17, 30, 32, 33, 35, 46, 47, 53 do include explicit citations while in figures 4, 19, 27, 28, 34, 38, 39, 40, 42, 48, 49, 51, 54 relevant data might be traceable by those with a reasonably good knowledge of the relevant field (e.g. when there is a unique data set held in an established central data repository). Appropriate citations should be either for the graphic as a whole or for the data sets that are plotted. Cases where neither of these is done are figures 1, 3, 5, 8, 9, 10, 11 (particularly for lower part), 12, 13, 15, 16, 18, 20, 21, 23, 24, 25, 26, 27, 29, 31, 37, 42, 44, 50 and 52. Problems with axis labelling (wrong numbers, missing numbers, incorrect labels) occur in figures 5 [item 15], 8 [item 16], 12 [item 29] and 14 [item 31]. (For comparison, the comparable issues with graphics in *An Inconvenient Truth* are a totally unquantified graph on page 89, no units on the plot on pages 78–79, and no temperature scale for the lower line on pages 66–67.)
4. In general the graphics are poorly linked to the text, with the text making no explicit mention of the graphics in virtually all cases. Apart from the issues of lack of citations and mislabelling of axes, noted in item 3, there are significant problems with the content of many of the graphs. By figure number, these are:
 - 1:** Misrepresents the HadCRUT data set and uses fabricated data for 2008 — [see item 6].
 - 3:** The data are distorted — [see item 12].
 - 5:** Falsified time axis, thus giving no indication of the Younger Dryas, in contradiction with text — [see item 15].
 - 10:** Lack of specifics makes the plot meaningless — [see item 17].
 - 11 (upper):** 'Hockey stick' data have been distorted — [see item 25].
 - 11 (lower):** values for 20th century have been distorted, end of MWP inconsistent with abrupt end described in text — [see item 25].

- 14:** While a citation is given, comparison with the cited source shows that one of the curves is not what Plimer claims it to be [see item 31].
- 15:** Time series truncated to shift relative degrees of correlation — [see item 32].
- 29:** The content is misrepresented — [see item 44].
- 38, 39, 40:** Plotted on different scales to try to imply trends are different (in violation of the basic laws of arithmetic) — [see item 51].
5. In analysing the details that follow, remember that *Heaven + Earth* is being promoted² as a scrupulous and scholarly analysis.
 6. p. 11, figure 11: This graphic has several misrepresentations. The bold line purports to be temperature data from the HadCRUT data set (see page 24 below). This is not true. The HadCRUT data are closer to the lighter solid line which is labelled, UAH LT (adj to Sfc)³ More seriously, at least for the HADCRU data⁴, the 2008 data that are shown are fabrications. The HadCRUT data set shows 2008 as being only 0.081°C lower than 2007 — [BB].
 7. p. 21–22: Biased comparison of IPCC ‘**balance of evidence**’ vs a survey that found only 10% of scientists **certain** that global warming is a process that is underway.
 8. p. 22: asserts that during the Medieval Warming, the global temperature was a few degrees warmer than today. This claim is asserted in various forms at many places through *Heaven + Earth*, mostly without any justifying citation. Many examples of changes for various regions are noted with citations, but there is no analysis of the overall results. The main places where the claim for a large and widespread Medieval warming is backed with citations are on page 63 [citing footnote 239] and page 490 [citing footnotes 2282 and 2283]. As noted in item 19, reference 239⁵ shows only a single time series for temperature. Item 97 notes that reference 2282 makes no mention of the MWP and reference 2283 (the first IPCC report) contains only a schematic with no temperature scale assigned. Similarly, item 20 notes that reference 255, cited in support of 2°C cooling from MWP to LIA only analyses the period 20,000 BP to 10,000 BP.
 9. p. 22: Misrepresents IPCC treatment of Little Ice Age (LIA), Medieval Warm Period (MWP). (See later — item 26).
 10. p. 22: Referring to the ‘hockey stick’ in the 2001 IPCC WG1 report: It was highlighted on the first page of the Summary for Policymakers and was shown another four times in the 2001 Summary for Policymakers. Since there are only five figures in the 2001 WG1 SPM, this would imply that all figures in the SPM include the ‘hockey stick’. This is quite simply false.
 11. p. 22: The IPCC, without explanation, quietly withdrew the “hockey stick” from the Summary for Policymakers in subsequent publications and had it buried in a scientific

²Cover ‘blurb’ by Lord Lawson of Blaby, on paperback edition.

³Presumably: University of Alabama Huntsville, Lower Troposphere (adjusted to surface).

⁴See page 24.

⁵Version 1.6 incorrectly referred to reference 9 at this point.

chapter of the 2007 report. with the footnote 24 noting as one of the reconstructions of past climate. The reconstructions, including that from Mann et al., are also in the technical summary (figure TS.20) of the 2007 report — [DK].

12. p. 25, figure 3: The graph has been distorted and misplotted. The line has the 1998 peak in about the right place relative to the scale, but the 1940 peak (labelled as such) appears in the 1950's and the 1975 trough is plotted nearer to 1979. (The Brave New Climate web site identifies this fabrication as coming from *The Great Global Warming Swindle*).
13. p. 25: There is no problem with global warming. It stopped in 1998. The last two years of global cooling have erased nearly thirty years of temperature increase. The last 30 years of temperature increase have not been erased. The HADCRU data set⁶ shows that both 2007 and 2008 have annual temperatures higher than any year prior to 1997 in the instrumental record.
14. p. 32: within a glacial period that has already lasted tens of millions of years, identified in footnote 38 as Pleistocene glaciation, sometimes called the Quaternary glaciation — implying a tens of millions of years duration for the 'Pleistocene' and 'Quaternary' that might surprise Plimer's geological colleagues.
15. p. 33, figure 5: Caption reads: The amount of temperature and temperature change This is two different things, but only one line is plotted. In addition, this unattributed graphic lacks any indication of the rapid cooling and warming associated with the beginning and end of the Younger Dryas [c.f. pages 42–44 and figure 10)]. Since the graph extends to the point labelled Today at 2000 on the time-scale, the description Time (years ago) is incorrect. However,⁷ comparisons with other publications indicates that this is rates of change from the GISP-2 ice core. However, in the 'original' graphic the time-scale was non-linear (possibly linear in depth), and the linear time-scale has been imposed by Plimer (with, as noted, the endpoint being inconsistent with the labelling). This is one of the weirder one's since Plimer's falsification of the time axis acts counter to his argument by removing the changes around the Younger Dryas.
16. p. 40, figure 8: lower part lacks numbers on horizontal axis.
17. p. 43, figure 10: The plot of ice accumulation is meaningless without saying where. Clearly, 0.2 metres/year for the last 10,000 years is not a global average.
18. p. 59: In the section on The Roman Warming Plimer states By 300 AD, the global climate was far warmer than at present.²¹⁷. Reference 217 is a 1977 book by H. H. Lamb which says little about Roman times. The strongest statement seems to be on page 4 saying that By late Roman times, particularly in the fourth century AD, it may well have been warmer than now, with 'now' meaning the mid 1970s.
19. p. 63: In the Medieval warming, it was far warmer than the present and the warming was widespread. The citation for this (footnote 239) is the book: *The Little Ice Age*. The

⁶File hadcru3gl.txt, see description on page 24.

⁷Clarification added in version 1.9.

index identifies four references to the MWP. One is a passing reference, one refers to sea level and one notes a subsequent cooling of 0.7°C to 1500. The most detailed discussion is on page 376 which presents only one time series of temperature estimates — 1000 years from central England. In addition, proxy series from Greenland and North America are shown without any temperature calibration, and combined into a ‘North Atlantic index’ again without any temperature scale assigned.

20. p. 66: Boreholes give accurate temperature histories for about 1000 years into the past because rock conducts past surface temperatures downward only slowly. In the Northern Hemisphere, borehole data shows the Medieval Warming and a cooling of about 2°C from the Medieval Warming to the Little Ice Age.²⁵⁵ — comparison with reference 255, a paper by Steig et al., reveals multiple misrepresentations by Plimer:
- i:** the paper refers to data from a core extracted from ice, not a hole drilled into rock;
 - ii:** the ice core is from the southern hemisphere, not the northern hemisphere;
 - iii:** the paper does not analyse the Medieval Warm Period. All data plots refer to the period from 20,000 BP to 10,000 BP – there appears to be absolutely no discussion of the Medieval period.
21. p. 66–67: A study of 6000 bore holes on all continents has shown that temperature in the Medieval Warm Period was warmer than today and that the temperature fell 0.2 to 0.7°C during the Little Ice Age. The cited reference (footnote 256) actually says that *temperature declined until about 200 years ago, reaching a minimum of about 0.2–0.7 K below present-day.* (i.e. the 0.2 to 0.7 K is the amount of offset from ‘present-day’, not the amount of fall from the MWP). The words that Plimer completely ignores are in the preceding passage, saying (relative to the period 1300–1600 BP): *A warming followed, yielding temperatures that averaged 0.1–0.5 K above present-day in the interval 500–1000 years ago.* The reference does not specify the time interval that represents ‘present-day’, but this global-scale estimate clearly differs from Plimer’s repeated unsubstantiated assertion that the MWP was 2 to 3 degree warmer than present. A later paper (by the authors of reference 256) *A late Quaternary climate reconstruction based on borehole heat flux data, borehole temperatures data and the instrumental record.* in *Geophysical Research Letters*, **35**, L13703 (2008) states *As the authors of HPS97 we can be criticized for not stating explicitly in HPS97 that the ‘present’ (the zero on the time axis) really represents something like the end of the 19th century, rather than the end of the 20th century.* The range of reconstructions in the 2008 paper, show a peak warming between 500 and 800 years ago, whose peaks, relative to to 1961–1990 mean, range from about -0.4°C to 0.3°C.⁸
22. p. 87: If it is acknowledged that there have been rapid large climate changes in the past, then human production of CO₂ cannot be the major driver for climate change. This makes the false assumption that there is an either/or choice between human and natural causes that applies at all times and on all time-scales.
23. p. 87: In the IPCC Second Assessment Summary for Policy Makers in 1996, a diagram

⁸The main issue here is that Plimer misrepresents reference 256, not that he failed to appreciate the significance of the upper 100 metres of data not being used.

showing the past 1000 years of Earth temperatures from tree rings, ice cores and thermometers showed the Medieval Warm period, the Little Ice Age and the Late 20th Century Warming. The SAR SPM does not include **any** diagrams. The temperature reconstruction in the *Technical Summary* of the SAR only goes back to 1400.

24. p. 88: Essentially repeats (in a slightly less specific form) the earlier false claim (on page 22) that ‘hockey stick’ occurs a total of 5 times in the IPCC 2001 SPM, [see item 10] — [DK].
25. p. 89, figure 11:⁹ In the upper part, the ‘hockey stick’ curve has been displaced upward relative to the version shown in the 2001 IPCC report, in spite of claiming to be the same reference period and having the 1998 instrumental values the same. In the lower part of figure 11, the depiction of the Medieval Warm Period is inconsistent with the claim on page 128 that The Wolf minimum heralded the end of the Medieval Warming and the beginning of the 600 year Little Ice Age. It took only 23 years to change from a warm climate to a cool climate. In addition the 20th century temperature data have been falsified by showing the 2000 temperature as almost exactly the same as the peak circa 1940 rather than 0.6°C higher.
26. p. 91: This makes a succession of claims about IPCC treatment of the Medieval Warm Period (MWP) , Little Ice Age (LIA) and hockey stick:

i: the 1996 IPCC report showed the Medieval Warm Period and the Little Ice Age

ii: Mann’s “hockey stick” was used in the IPCC’s 2001 report and the Medieval Warm Period and the Little Ice Age were expunged

iii: In the next IPCC report the Medieval Warm Period and the Little Ice Age mysteriously re-appeared (i.e. the 2006 report).

In reality, the only reconstruction in the 1996 report appears to be the Bradley estimates (figure 10 in the technical summary, reappearing with thermometer measurements superimposed as figure 3.20, page 175 in WG1 SAR) which only went back to 1400 (i.e. after Plimer’s definition of end of MWP). (Figure 3.21 shows proxies without any temperature relation and with poor coherence around the time of the MWP). Thus the MWP was not in the 1996 report to be ‘expunged’ in 2001. The ‘reappearance’ in 2007 is to have multiple reconstructions, none of which show a MWP even 1°C warmer than the second half of the twentieth century, let alone the 2°C that Plimer claims. The LIA can be seen in all 3 reports, with most reconstructions suggesting about 0.5°C below mid 20th century levels. In the 2007 report, a small number of reconstructions suggest LIA temperatures nearer to 1°C cooler and MWP a few tenths of a degree cooler. (Note that all this refers to the northern hemisphere).

27. p. 98: The GISS director³⁹⁸ claimed that nine of the ten warmest years in history have occurred since 1995, . . . Since reference 398 is a paper published in 1999, the misrepresentation is obvious.

⁹Prior to version 1.7, the page was incorrectly given as 99.

28. p. 99: Following soon after the previous passage ... NASA had to reverse its position ... NASA now states that the top four years of high temperatures are from the 1930s (1934, 1931, 1938 and 1939). The warmest year was 1934. Shortly afterwards: Similarly the UK's Meteorological office has now confirmed a fall in global temperatures. ... Nowhere in this discussion of global temperatures is the acknowledgement that interpolation about the high temperatures in the 1930s (the subject of the NASA revision to statements about extremes) refers to the USA and not the whole world. The revision to the USA data changes the global numbers by a few thousandths of a degree.¹⁰ — [also in TL list].
29. p. 110, figure 12: The lower plot on this figure has a label referring to late twentieth century warming, with a time line in 'years before present'. However the line ends at about 60 years ago. Maybe Plimer is anticipating the book being in print, without revision in 2060! However the real howler in this plot is that the temperature increase is shown as about 40°C. In addition, the relation between upper (10000 years of C-14) and lower (1100 years of temperature) parts of the figure is unclear.
30. p. 121: the sun rotates around the centre of gravity of the solar system about every 11.1 years. Plimer is confusing rotation (about once every 25 days) with orbital motion around the center of gravity. According to Einstein's principle of general relativity, such orbital motion can have no detectable effect. There can be tidal effects, but these will have a frequency given by the difference: $1/25 - 1/(365 \times 11.1)$ per day, i.e. not much less than once every 25 days.
31. p. 126, figure 14: A correlation of cycles over less than 2 cycles is of no significance. Many correlations with sunspot data have failed (A.B. Pittock, formerly of CSIRO: personal communication based on published work and work in progress). Note that the curves are labelled 'sunspot numbers' and 'Grain price' while the vertical axes are labelled 'number of sunspots' (meaningless unless the time interval specified) and 'W/m²' — a novel unit for grain prices. However, Tim Lambert's comparison with the original source [figure 7.41 in reference 550] reveals a more complicated degree of falsification:
- i:** The curve reproduced as Sunspot numbers is 'solar insolation' (*Sonneneinstrahlung* in the reference 550) and is quantified on the right-hand axis which has the same numerical values as in *Heaven + Earth* in W/m².
 - ii:** In the original, the left hand axis is prices, *Getreidepreise (Mariengroshchen pro 100 kg)*, with the range 100 to 200, i.e. the numbers that Plimer relabels as Number of sunspots.
32. p. 131, figure 15 (caption): Plot of the last 140 years ... no it isn't. The plots, starting at 1860 end a little after 1980 (although the time axis extends beyond 2000). Truncating the plots in this way serves to reduce the correlation between temperature and CO₂ and enhance the correlation between temperature and sunspot cycle length.
33. p. 132: Greenhouse gases act only as amplifiers. In using the word **only**, Plimer fails to explain how greenhouse gases can have a (amplifying) warming effect when the gas

¹⁰The transcript of the *Lateline* interview where Ian Plimer tries to evade this issue, can be found on: <http://www.abc.net.au/lateline/content/2008/s2554129.htm>

increase is due to other climate change (as in the mainstream interpretation of glacial-interglacial cycles) and yet not have a warming effect when the gas increases are due to human inputs.

34. p. 133: States: Ice cores from Greenland show the temperature was warmer at 1000 AD. while the cited reference (footnote 595) indicates that the data are not from the ice core (i.e. the ice extracted from the drill-hole), but are from measurements of temperatures in the hole — [contributed suggestion].
35. p. 148: Earth has less carbon and water than other planets, asteroids and comets A very strange statement, particularly for Mercury, Mars and the asteroids — [DK].
36. p. 195: On the global scale satellite measurements of vegetation between 1982 and 1999 showed that plant growth increased by 6% in response to slightly increased rainfall and slightly increased temperature, but the major change was due to slightly increased CO₂. There is no reference directly associated with this passage but the preceding passage cites the paper *Climate-driven increases in global terrestrial net primary production from 1982 to 1999* [footnote 936] by Nemani et al. (2003). This paper did not provide any specific satellite-derived estimate of the effect of CO₂.
37. p. 198: In fact the sea-ice has expanded and high winds during an Arctic storm killed four polar bears .. Indeed saying sea-ice has expanded may well be true if one writes during the northern winter. The end-date of the record shown as the lower curve in Figure 29, suggests such ‘cherry-picking’. However, the purported Arctic data are a misrepresentation of the source. The curve is a global anomaly — see item 44.
38. p. 217: Mt Pinatubo . . . released 20 millions tonnes of sulphur dioxide and very large quantities of chlorofluorocarbons. . . . The reference cited for this [footnote 1075] makes no such claims and is not reporting observations of anything. It is about a modelling study that compares the chemical effects of Pinatubo emissions to the effect of chlorofluorocarbons — [also in TL list].
39. p. 219: An almost entirely eruption-free period from 1912 to 1963 coincided with an average global warming of 0.5°C. It is quite possible that the atmosphere warmed due to the lack of a normal quote of volcanic aerosols. Precisely. This statement completely undermines Plimer’s arguments that CO₂ can’t be causing later warming because there was too little CO₂ increase at the time of early 20th century warming.
40. p. 229: In about 9000 years time, perihelion will occur in the Northern hemisphere and aphelion will occurs in the Southern hemisphere, the reverse of today. This is absurd. Perihelion and aphelion are points on the Earth’s orbit and do not occur **in** a specific hemisphere.
41. p. 230: claims that climate models don’t do seasonal variation of insolation, i.e. neglect the ellipticity of the Earth’s orbit. The mean figure of 1367 watts per square metre is used in climate models, thereby omitting the effects of orbit on the change in solar input. This is untrue (personal communication from CSIRO climate modellers). An older, but verifiable and more accessible reference is CSIRO Division of Atmospheric Research

Technical Paper no. 26, available on-line from the CSIRO Marine and Atmospheric Research website. Numerous studies have been done with climate models using different values of ellipticity (and different orientations of the Earth's axis) in order to study other stages of the Milancović cycle. Such studies would be impossible if the shape of the earth's orbit is ignored.

42. p. 277: The initial analysis of the Vostok ice core used samples spaced at intervals of hundreds of years. The initial conclusions were that high CO₂ in the atmosphere led to high temperatures. This is untrue. The initial conclusions over 20 years ago were that the cycles were initiated by orbital changes with changes in CO₂ having a consequent amplifying role. In the relevant paper, the abstract (quoted in full in the discussion below on the Vostok core, see page 27) says *CO₂ changes have had an important climatic role ... in amplifying the relatively weak orbital forcing.*
43. p. 281: The good news is that alpine valley glaciers are not retreating. Measurements of retreats and advances from glaciers in the period 1946–1995 for 246 glaciers show that there is no sign of any recent global trend towards increased glacier melting.¹⁴⁴¹ The first sentence does not follow from the first: reference 1441 does find that glaciers are retreating, but fails to find evidence of an increased rate of retreat — [TL].
44. p. 287, figure 29: A graph that claims to be area of global sea ice with total area of Antarctic sea ice (upper curve) and Arctic sea ice variations (lower graph) shows negative values for the arctic. In reality, the curve seems to be taken from the site: <http://arctic.atmos.uiuc.edu/cryosphere/IMAGES/global.daily.ice.area.withtrend.jpg>
This identifies the lower curve as daily global sea ice anomaly and not Arctic sea ice variations (lower graph).
45. p. 297 (also on p. 294): El Niño events are not factored into models of future climate. This is untrue. In the WG1 AR4 report, figure 8.13 shows the performance of a range of the climate models in simulating the statistical characteristics of El Niño. Since the El Niño is recognised as part of the chaotic behaviour of the climate system (in spite of Plimer's claim, item 86, that the IPCC denies this) the sequence of individual El Niño events is unpredictable and the relevant test is of the intensity and frequency distribution — [DK].
46. p. 303: In the three years before the flooding associated with hurricane Katrina devastated New Orleans in August 2005, the city and surrounding area had undergone rapid subsidence of about one metre. There is no reference associated with this claim. However, when the claim is repeated on page 409 a reference is cited, but the subsidence reported in that reference represents an average of 16.8 ± 7.5 mm over the three years — see item 66.
47. P 312: Al Gore's Oscar winning movie predicted that sea level would increase by 6 metres in the near future Gore does not put a date on when a 20 foot rise would happen (nor specify what circumstances). In my view this is one of the serious omissions in Gore's book. My recollection is that a similar view of this omission was taken by the judge in the UK court case over Gore's film and book.

48. p. 324, caption of figure 34: These bottom waters are undersaturated in CO₂ hence can dissolve the monstrous amounts of CO₂ emitted by submarine volcanoes. This fails to account for what happens when this water is upwelled to the surface, become oversaturated due to the lower pressure.
49. p. 325:¹¹ The sentence An upper limit on how much CO₂ concentration in the atmosphere will rise if all the available fossil fuel is burned can be calculated. Is followed immediately by In order to permanently double the current level of CO₂ in the atmosphere and keep the oceans and atmosphere balanced, the atmosphere needs to be supplied with 51 times the present amount of atmospheric CO₂. The shift in the argument is the inclusion of the word **permanently**, making the comparison misleading. Indeed without specifying the time-scales, the comparison is meaningless. On the time-scales of tens of millions of years, the geological evidence suggests that the factor of 51 is too small. On timescales of millennia, geological analysis suggests that the factor is in the range 5 to 10. On the century timescale, the factor is closer to 2. A good conceptual analysis of these issues is given by Eric Sundquist of the US Geological Survey in his chapter *Geological perspectives on carbon dioxide and the carbon cycle* [Plimer's footnote 2117].
50. p. 338: There is no such thing as a “tipping point” (or even a “precautionary principle”) in science. The precautionary principle is proposed for the conduct of human affairs. No-one seriously proposes it as a scientific principle. (If it was a scientific principle there would be no need to argue for its use — it would just happen). There is such a thing as a “tipping” point in science, but the more technical name is “catastrophe”. An accessible account is given in the book *Catastrophe Theory* by V. I. Arnold (Springer-Verlag, 1984, 1986). Since not all things that are catastrophes in the mathematical sense are catastrophic in the human sense, the use of a less ambiguous term such as “tipping point” seems desirable for public communication.
51. p. 346–347, figures 38, 39. 40: Annual averages show sea surface temperature rises whereas monthly averages do not. and in the caption of figure 40: The three diagrams show that the data can easily be manipulated to create a desired outcome. Actually **no**. In particular the linear trend will be almost the same in each case, with small differences coming from a few months at the end. Fitting a trend to monthly, 5-monthly or 12-monthly averages involves (apart from the ends and some rounding of times) the same sums over the same months, whether or not one deals with averages. Using 5-month averages just means that each month gets added in 5 times (and divided by 5). From the basic laws of arithmetic, the sum of a set of numbers does not depend on the order in which they are added. So why do the graphs seem to have different trends: because they are plotted on different scales. Each actually shows about 0.7°C increase over the 40-odd years. This same scam was used by Michael Crichton in *State of Fear* comparing US and global data — see section 3.2 of *Twisted*.
52. p. 350: The El Niño most commonly occurs in late December, lasts for a month or so ... compared to p. 352 El Niño lasts for 1 to 2 years.

¹¹In versions prior to 1.6, this issue was incorrectly noted as being on page 235.

53. p. 365: Clouds are not factored into climate models. Untrue. See for example sections 12 and 13 of CSIRO Division of Atmospheric Research Technical Paper no. 26, available online from the CSIRO Marine and Atmospheric Research website. Also many textbooks.
54. p. 366: assertion of the 0.5°C climate sensitivity with no citation and contradicting other values given by Plimer [items 83, 99] — [TL].
55. p. 366: The Earth has an average surface temperature of about 15°C, followed a few sentences later by If the atmosphere had no CO₂ far more heat would be lost and the average surface temperature would be about -3°C. The implication of attributing 18°C of warming to CO₂ while saying [caption of Figure 44] About 98% of the greenhouse effect in the atmosphere is due to water vapour is to imply that in the absence of CO₂ and H₂O, the temperature would be 900°C lower, i.e. well below the physical limit of absolute zero.
56. p. 367: However, Arrhenius was not aware of the carbon cycle Arrhenius' 1896 paper explicitly includes geological aspects of the ocean carbon cycle, drawing on the work of geologist Arvid Högbom, going to the extent of providing a summary translation of some of Högbom's work at the end of his own paper.
57. p. 370, figure 44: As noted in item 55, the exaggerated proportion of warming attributed to water vapour in the graphic and caption, implies that water vapour is warming the planet from a temperature below absolute zero — [also in TL list].
58. p. 371: assertion of the 0.5°C climate sensitivity with no citation and contradicting other values given by Plimer [items 83, 99] — [TL].
59. p. 374: Once there is 400 ppm of CO₂ in the atmosphere, the doubling or tripling of CO₂ content has little effect on atmospheric temperature because CO₂ has adsorbed all the infra-red it can adsorb. The term '**adsorb**' is defined (Macquarie Dictionary) as "to gather a gas, liquid or dissolved substance) on the surface of a condensed layer . . .", c.f. '**absorb**' for which the same dictionary's definitions include: **5.** *to take or receive in by chemical or molecular action* while Chambers Twentieth Century dictionary's definition of 'absorb' includes: "to suck in, to swallow up, ... to take up and transform (energy) instead or transmitting or reflecting". An consistent failure [see item 75] to distinguish between 'adsorb' and 'absorb' does not inspire confidence.
60. p. 375, figure 50:¹² As with many of the graphics, this is poorly described with no attribution of the numbers (see item 3). However above 100 ppm the values seem to be inversely proportional to concentration as expected for incremental change when temperature has a logarithmic dependence on concentration (which Plimer acknowledges on p. 338). Thus a better label for the vertical axis would be 'incremental warming'. This means that the claim in the caption once the atmosphere is at its present 385 ppm, a doubling or quadrupling will have very little effect on the atmospheric temperature is untrue. (Note also similar statement on previous page — item 59). Each doubling will have the same

¹²Prior to version 1.4, this was incorrectly noted as fig 5.

effect on temperature until concentrations get so high that the logarithmic relation breaks down. The trend in Figure 50 shows no sign of this happening around 400 ppm. The bars would imply that the increments correspond to each additional 20 ppm of CO₂. This would imply a climate sensitivity of 0.35°C. While the origin of the numbers is not given, the discussion on page 24 below notes that they can be explained by using 0.5°C for the climate sensitivity (the lowest of Plimer's other values) and then having a factor of 1.44 error through neglecting to consider the change of base of logarithms.

61. p. 379: *In fact, satellites and radiosondes show that there is no global warming.*¹⁹¹⁰. Reference 1910 is a 2007 overview by Charles F. Keller which updates his 2003 report (CFK03). The words in reference 1910 are: *The big news since CFK03 is the first of these, the collapse of the climate critics' last real bastion, namely that satellites and radiosondes show no significant warming in the past quarter century.* Reference 1910 describes the issues with the satellite and sonde data that gave the incorrect appearance of no trend.
62. p. 382: *In fact, satellites and radiosondes show that there is no global warming.*¹⁹¹⁸. Reference 1918 is the same reference as 1910 and so the comments in item 61 apply equally here — [TL].
63. p.398: *attempts to use only stalagmite ring widths to ascertain climate variation shows that there is no relationship between stalagmite ring width and tree rings in the same area.*¹⁹⁹⁰ when in fact reference 1990 makes no mention of tree rings — [email contribution].
64. p. 402: *There was no "tipping point" and the temperature-CO₂ plots clearly showed that the rise in temperature was stopped by something other than CO₂.*²⁰⁰⁷ — comparison with reference 2007, a paper by Wunsch, reveals that the paper does not discuss any aspect of CO₂.
65. p. 407: *Actual measurements for 2007 show that it was one of the coldest years this century and the coldest since 1995.* Compare to figure 1 on page 11 of *Heaven + Earth*. The claim 'coldest since 1995' is clearly untrue. Calling it 'one of the coldest this century' (i.e. not even *the coldest* is fairly insignificant with only 8 or 9 years (depending on whether you regard the century as beginning on 1/1/2000 or 1/1/2001)).
66. p. 409: *New Orleans sunk rapidly by about 1 metre in the three years before Katrina struck.* This time (unlike page 303, item 46) a reference is cited: by Dixon and others *Nature*, **441**, 587–588 (2006) from radar satellite altimetry. They report a three-year average of -5.6 ± 2.5 mm/year, with a maximum of -29 mm/year (negative values indicating subsidence). They note that if the motion is interpreted as purely vertical, the mean and maximum subsidence become 6.4 mm/year and 33 mm/year.
67. p. 411: *Carbon dioxide is a colourless odourless non-poisonous gas.* If taken literally, this is dangerously misleading. Some of the relevant toxicity data from *Chemwatch #1003 (1999)*¹³ are:

¹³The summary is for illustrative purposes. Health and Safety issues should be addressed by reference to the full chemical data sheets.

7% to 10%: unconsciousness within minutes;
5% fatal dose for inhalation;
2% adverse pulmonary effects;
and various adverse effects from continuous exposure at lower concentrations around 1%.

68. p. 413: Animals produce 25 times as much CO₂ as cars and industry. Irrelevant and untrue. A common irrelevant argument used by doubt-spreaders. Animal CO₂ production doesn't affect climate because it is putting back carbon taken out of the atmosphere by plants. However 25 by 7 GtC/year is exaggerated. Even if no plant material decayed directly to CO₂, or decomposed by bacteria or burnt by wild-fire, Plimer's figures would have animals chomping through plant material at about 2 or 3 times the rate (the Global Net Primary Production of 50 to 100 GtC per year) at which plants remove the carbon from the atmosphere — thus eating all the world's biomass in a few decades.
69. p. 415: The C¹⁴ proportion of total carbon in the atmosphere is decreasing, suggesting that there is an increased biological contribution of CO₂ to the atmosphere. The proportion of atmospheric ¹⁴C is decreasing because atmospheric CO₂, with ¹⁴C from nuclear testing is being taken up into the oceans and replaced by (old) CO₂ upwelled from the deep oceans and so uninfluenced by the nuclear testing. Note that this interpretation of the ¹⁴C data lies behind some of the estimates of air-sea gas exchange that Plimer mis-interprets as estimates of 'CO₂ lifetime'.
70. p. 417: ..the observatory was evacuated for a few months and there was a gap in the data record which represented a period of no measurements. There are now no gaps in the Mauna Loa data set. To refer to **the** Mauna Loa (CO₂) data set, is misleading since there are three main records: The Scripps in-situ IRGA measurements established by C. D. Keeling; the NOAA in-situ IRGA measurements and the NOAA flask program which is part of a global network for which flasks of air are shipped back to the central NOAA laboratory in Boulder, Colorado. The main archive/access location for CO₂ data is the Carbon Dioxide Information and Analysis Center (CDIAC), in Oak Ridge, Tennessee. Other programs such as CSIRO also produce records from Mauna Loa as part of the on-going validation activity. The graphic at:
http://cdiac.ornl.gov/trends/co2/graphics/Mauna_Loa_CO2.jpg shows extensive gaps in the early part of the Scripps record.
71. p. 417: The annual mean CO₂ atmospheric content reported at Mauna Loa for 1959 was 315.93 ppmv. This was 15 ppmv lower than the 1959 measurements for measuring stations in northwestern Europe. Measured CO₂ at Mauna Loa increased steadily to 351.45 ppmv in early in 1989. The 1989 value is the same as the European measurements 35 years earlier by the Pettenkofer method.... Plimer's references for the European program are two papers by Bischof in 1960 and 1962 [footnotes 2094 and 2095 respectively]. The 1960 paper quotes annual means of — 1955: 326 ppm; 1956: 321 ppm; 1957: 323 ppm; 1958: 315 ppm; 1959: 331 ppm. For such a short passage, Plimer is showing a remarkably high number of errors:
i: 1959 to 1989 is 30 years, not 35 years;
ii: 15 ppm above 315.9 ppm is 330.9 ppm, close to the annual mean reported for Mauna

Loa for 1975, not 1989.

iii: during 1959 the Swedish group switched to the more precise Infra-Red Gas Analyser (IRGA) with precision determined as ± 1 ppm, while they found the precision of the chemical method to be ± 3 ppm — thus the 1959 data were not all from the chemical method;

iv: the whole comparison is biased by comparing a high altitude site with surface data. The relevant comparison is with the data reported by Bischof (1962), sampling air during aircraft flights. The values for air from above about 1km are from 308 ppm to 320 ppm with a mean of 314 ppm, very close to the 315 ppm at Mauna Loa.

72. p. 417–8: Furthermore, the measurement at Mauna Loa is by infra-red analysis and some of the ice core measurements of CO₂ in trapped air were by gas chromatography. Exactly. There are two techniques, IRGA and GC, with good precision and which agree with each other, and a third (chemical) technique with inherently lower precision which requires great experimental skill to achieve accuracy.
73. p. 418: land-derived air blowing across the sea loses about 10 ppm of its CO₂ as the CO₂ dissolves in the oceans. High-CO₂ air from over land often has the concentration drop due to vertical mixing. A more realistic estimate of how much drop can be caused by the oceans (over large areas) is obtained by comparing measurements of CO₂ at Cape Grim Tasmania which, when measured in air coming off the ocean averaged about 1 ppm lower than air measured by CSIRO on flights over Bass Strait.
74. p. 419: The lowest figure measured since 1812, the 270 ppm figure, is taken as the pre-industrialisation yardstick. The IPCC want it both ways. They are prepared to use the lowest determination by the Pettenkofer method as a yardstick yet do not acknowledge Pettenkofer method measurements showing CO₂ concentrations far higher than now many times since 1812. The IPCC does not use 270 ppm as the pre-industrial CO₂ concentration. The value used is 280 ppm. In the various WG1 reports, see SPM table 1 in 1990, technical summary (TS) table 1 in SAR, TS table 1 in TAR, and page 2 in SPM of AR4. This number is based in measurements of air in ice bubbles (mainly using IR techniques) and excluding anomalously low values from the time of the Little Ice Age. For ice cores, the volume of air available is too small to use the less precise chemical (Pettenkofer) method.
75. p. 421: CO₂ molecules will be removed fast from the atmosphere to be adsorbed in another reservoir — inability to distinguish ‘adsorbed’ from ‘absorbed’ yet again — see item 59.
76. p. 421: For CO₂, The IPCC asserts that the lifetime is 50–200 years. The IPCC has been criticised because the lifetime is not defined. In reality the IPCC (1990) says in the SPM The way in which CO₂ is absorbed by the oceans and biosphere is not simple and a single number cannot be given and in the footnote to table 1: The “lifetime” of CO₂ is given in the table is a rough indication of the time it would take CO₂ concentrations to adjust to changes in emissions. (see section 1.2.1 for further details), with section 1.2.1 stating The turnover time of CO₂ in the atmosphere, measured as the ratio of content to the fluxes through it is about 4 years. ... This short time scale must not be confused with the time

it takes for the atmospheric CO₂ level to adjust to a new equilibrium of sources or sinks change.

77. p. 422: Calculations of the lifetime of atmospheric CO₂ based on natural C¹⁴ give lifetime values of 3 to 25 years (18 separate studies), dilution of the atmosphere from fossil fuel burning a lifetime of 2 to 7 years (two separate studies), atomic bomb C¹⁴ lifetime value of 2 to more than 10 years (12 separate studies) . . . The is referenced by footnote 2117 at the beginning and footnote 2118 after additional cases not quoted above. This makes it difficult to identify which citation applies to which group of claims. In the case of footnote 2117 (Eric Sundquist's article *Geological perspectives on carbon dioxide and the carbon cycle*, noted above in connection with item 49), the misrepresentation is particularly clear. Sundquist describes carbon balance and the decay of perturbations in terms of competition between the flux to and from the atmosphere. In these terms his estimates are of the one-way fluxes, i.e. Plimer is omitting half of Sundquist's calculation, thus turning approximate balance into a claim of rapid net loss of CO₂ from the atmosphere.
78. p. 422: There is considerable difference in the atmospheric CO₂ lifetime between the 37 independent measurements and calculations using six different methods and the IPCC computer model. This discrepancy has not been explained by the IPCC. As noted in item 76, Plimer is misrepresenting estimates of turnover time as being estimates of a characteristic lifetime for CO₂ perturbations. The difference **has** been explained in IPCC reports — see in particular section 2.1.4 of the WG1 Second Assessment Report. (Of course, in criticising **the IPCC computer model**, Plimer is referring to something that doesn't actually exist).
79. p. 422: If the CO₂ atmospheric lifetime were 5 years, then the amount of the total atmospheric CO₂ derived from fossil fuel burning would be 1.2% not the 21% assumed by the IPCC. This would appear to conflict with Oceans, soils and plants already absorb at least half the human CO₂ emissions on page 472. In fact both statements are roughly true — the conclusion that resolves this apparent conflict is that a 5-year 'atmospheric lifetime' does **not** characterise atmospheric CO₂.
80. p. 425: The IPCC 2007 report stated that the CO₂ radiative forcing had increased by 20% in the last 10 years. Radiative forcing puts a number on increases in radiative energy in the atmosphere and hence the temperature. In 1995, there was 360 ppmv of CO₂ whereas in 2005 it was 378 ppmv, some 5% higher. However each additional molecule of CO₂ in the atmosphere causes smaller radiative forcing than its predecessor and the real increase in radiative forcing was 1%. The IPCC have exaggerated the effect of CO₂ 20-fold. As Plimer notes, radiative forcing is about **increases**. The IPCC (see AR4 WG1 glossary) defines radiative forcing as the change relative to the year 1750. This is also noted in footnote 2 of the SPM when the concept of radiative forcing is introduced. Using the logarithmic formula to account for the diminishing effect of additional CO₂, =log(378/280)/log(360/280) in a spreadsheet, gives a 1.194 multiplier from 1995 to 2005, i.e. a 19.4% increase. This does not depend on the value of the climate sensitivity. The same result is obtained with any of Plimer's 3 values (0.35°C from figure 50, the 0.5°C that he asserts without citation, or the 1.5°C to 1.6°C from the long-term historical

data that he cites, e.g. item 83). (A value of 20% is obtained if the 1750 concentration is taken as 282 ppm.) — [also in TL list].

81. p. 425: IPCC does not acknowledge that CO₂ derived from human activity produces 0.1% of global warming.¹⁴ Using Plimer's preferred (but unrealistically low) climate sensitivity of 0.5°C, typing $=1.44*0.5*LN(385/280)*1000$ into a spreadsheet gives a warming of 229°C, implying that without human and natural greenhouse gases, the temperature of the earth would be like that of the outer planets. Using the empirical (but still unrealistically low) estimate of 1.5°C quoted by Plimer on page 426 would imply that without human and natural greenhouse gases, the temperature of the Earth would be below the physical limit of absolute zero.
82. p. 425: During times of ice ages such as 140,000 years ago, the CO₂ content of the atmosphere was higher than the pre-industrial revolution figure of 270 ppmv.²¹³⁴ This is 'cherry-picking' from two different estimates of the Vostok dating. According to reference 2134 (published in 1990), 140,000 years ago, the CO₂ concentration was around 270 ppm, but the world was no longer in an ice age. According to more recent dating¹⁵, 140,000 years ago CO₂ was below 200 ppm and significant warming did not begin until about 500 years later — [DK].
83. p. 426: The variation in CO₂ shows that a climate sensitivity of greater than 1.5°C has probably been a robust feature of the Earth's climate system for over 420 million years. This contradicts his frequent undocumented assertion [items 54, 58, 94] that the climate sensitivity is 0.5°C.
84. p. 437: If governments had read the fine print of the crucial chapter 5 of the IPCC AR4 (Humans responsible for climate change) they would have realised that it was based on the opinions of just five independent scientists. This implies that the chapter is called Humans responsible for climate change. This is untrue. In the AR4 WG1 report chapter 5 is called Observations: Oceanic Climate Change and Sea Level. The words Humans responsible for climate change are not the title of any section or subsection of chapter 5 (nor the title of any other chapter in the AR4 WG1 report). The executive summary of chapter 5 does not include any discussion of attribution of responsibility for the changes that are described. The total number of authors is 13, coming from 9 different countries with Corrinne Le Quéré spending part of her time in a 10th country. Similarly, in the AR4 reports from working groups 2 and 3, neither chapter 5 nor any other chapter has the title Humans responsible for climate change — [also in TL list].
85. p. 438: The IPCC has essentially ignored the role of natural climate variability. In reality the various IPCC WG1 reports have chapters entitled: 7: Observed Climate Variations and Change (1990); 3: Observed Climate Variability and Change (1996); 2: Observed Climate Variability and Change (2001); 6: Paleoclimate (2007).
86. p. 439: referring to the 2001 report the report of the IPCC claimed that, based on computer model simulations, climate has only limited variability and hence was not dynamic,

¹⁴The summary in versions up to 1.5 incorrectly gave Plimer's number as 1%.

¹⁵Using the dataset described on page 27.

non-linear and chaotic. Actual words [page 95, WG1 report, TAR] are: *Since the pioneering work of Lorenz in the 1960s, it is well known that complex non-linear systems have limited predictability, even though the mathematical equations defining the time evolution of the system are perfectly deterministic. The climate system is, as we have seen such a system*

87. p. 439: In discussing the role of chaos: *Five simulations were undertaken for the period 1860–2000 using the same general circulations models that are used by the IPCC. Each simulation had slightly different initial conditions, but otherwise was the same. Very small differences in the initial conditions of climate resulted in large differences in large variations in later climate.*²¹⁷⁸ This has minor misrepresentations: there was only one model, and the initial conditions were different weather ‘snapshots’ from a control run with only internal climate variability¹⁶. The serious misrepresentation is that of large differences in later climate. There were, as expected, large differences in subsequent weather variations, but the later climates (i.e. multi-decadal averages and trends) were quite similar.
88. p. 443 [footnote 2181]: repeats Monckton’s claims about *An Inconvenient Truth* without mentioning that most were rejected by the court.¹⁷ More precisely, what the judgment¹⁸ says of the plaintiff’s counsel is that *Mr. Downes produced a long schedule of such alleged errors and waxed lyrical in that regard.* and later *In the event I was persuaded that only some of them were sufficiently persuasive to be relevant for the purposes of his argument, and it was those matters — 9 in all – upon which I invented Mr Chamberlain*¹⁹ to concentrate. There-after, the judgement uses quotation marks around the word “errors”.
89. p. 472: *Oceans, soils and plants already absorb at least half the human CO₂ emissions* Uptake of just over half of human emissions by the oceans, soils and plants is the view of mainstream science. The reason to note this statement by Plimer is that it is inconsistent with Plimer’s claims about CO₂ lifetimes and large emissions from volcanoes. In particular, with the 4-year lifetime that Plimer claims, the only way half of human emissions can be in the atmosphere is if most emissions have occurred within the last few years.
90. p. 477–478: The discussion of Stern’s work quotes a paper by Klyashtorin and Lubushin (footnote 2221) when referring to *data from many sources.* The Klyashtorin and Lubushin paper is often cited (and mis-quoted) by pseudo-sceptics/doubt-spreaders. It finds no correlation between detrended series for temperature and fuel use. It is not comparing temperature to fossil carbon emissions. It is comparing temperature to what the carbon emissions would have been if all energy use (including nuclear) had come from oil. As described in *Twisted*, a number of other aspects of the fit act to reduce the type of correlation that would be obtained. However, in *Heaven + Earth* the citation is essentially irrelevant.

¹⁶and as always, the false claim that the IPCC ‘uses’ the models

¹⁷The first sentence of this item was included as a contribution from Tim Lambert and temporarily dropped until I had time to expand on the word ‘rejected’.

¹⁸Available from <http://www.bailii.org/ew/cases/EWHC/admin/2007/2299.html>

¹⁹For the defence.

91. p. 479: Footnote 2235 is a repeat citation of footnote 2221, the Klyashtorin and Lubushin paper [see item 90]. Since its sole climate analysis is comparing temperature to energy use (and finding *no true linear correlation* in the detrended series), this citation provides no meaningful support for the statement that *the next major climate change will be cooling.*
92. p. 484: The 2007 IPCC SPM *showed cooling for 100 of the last 160 years, during which time greenhouse gases were increasing.* Up to version 1.4, my response was: *Possibly true but irrelevant — what matters is if net year-to-year increase is significantly positive.* However, on the basis of random walk statistics, my vague scepticism in saying *possibly*, should be changed to *highly unlikely and irrelevant*. A more complete comment is *highly unlikely, irrelevant and yet another fabrication*. The SPM figure is repeated in chapter 3 (in the FAQ section) of WG1 AR4, where the source of the numbers is identified as the HadCRU3 data set. Looking at the year-to-year changes²⁰ reveals 80 increases and 78 decreases. (The ‘variance reduced’ HadCRU3 set has 78 decreases and 80 increases) — [also in TL list].
93. p. 485: *The Montreal Protocol used the precautionary principle to attempt to ban chloro-fluorocarbons because these gases destroy ozone. However we use chlorine every day to make water fit to drink and yet chlorine also destroys ozone. There is no such thing as the precautionary principle in science.* This misrepresentation of the precautionary principle is discussed in item 50. The passage misrepresents the role of chlorine, in that reactive chlorine compounds are removed in the lower atmosphere (mostly ending up as water soluble compounds that dissolve in rainwater) while unreactive compounds such as CFCs are only destroyed in the stratosphere (due to higher UV levels) and where rain-out does not occur. It is the chlorine from CFC breakdown that destroys ozone — Plimer’s use of the word ‘also’ suggests that he doesn’t understand this — [also in TL list].
94. p. 488: another undocumented assertion of the 0.5°C climate sensitivity.
95. p. 488: *the IPCC models just don’t do clouds* — false — see item 53.
96. pp. 489–493: Choosing to end with a summary from someone (Viscount Monckton) who is not a scientist is a strange choice. Some of the points [items 97, 98] are particularly questionable.
97. p. 490: present temperature is .. *up to 3°C below the Minoan, Roman and Medieval warmings*^{2282,2283}. The cited references (2282 is for Vostok ice core data and 2283 is the 1990 IPCC report) do not support this claim of up to 3°C. The Vostok paper does not refer to the MWP and the IPCC report has only a schematic [figure 7.1] with no units on the temperature scale.
98. pp. 491–492: *Sea level may rise by 1 foot to 2100, not 20ft as Gore claims.* A variant on the incorrect claim made on page 312, see item 47. Gore does not put a date on when a 20 foot rise would happen (nor specify what circumstances). My recollection is that this omission was noted by the judge in the UK court case over Gore’s film and book, a case in which Monckton was involved.

²⁰File hadcru3gl.txt, see description on page 24.

99. Plimer asserts that the world was only 7°C warmer with 20 times the amount of atmospheric CO₂. This gives the impression that the effect of CO₂ on climate is small, but ignores the logarithmic dependence. This dependence has been known since Arrhenius, acknowledged by Plimer on p. 338 (with the consequent incremental changes illustrated in figure 50) and often cited by greenhouse pseudo-sceptics such as Bob Carter as a reason for not worrying. If taken at face value, this assertion would imply a climate sensitivity of 1.6 degrees — just over half Hansen’s estimate and below the lower end of the IPCC range, but still not insignificant. This can be easily checked by typing $= 7.0 * \log(2.0) / \log(20.0)$ into a spreadsheet.

Contributed comments

This section contains contributions from Tim Lambert from the list on his Deltoid blog [TL], Steven Sherwood [SS]. The source of each item is indicated by the author’s initials. This section and the following section have comments in outline form. Where I have expanded this type of contribution to a more complete version it is in the main list.

100. Figs. 1, 3 and 4 are all very inconsistent, esp. 1 and 4 which purport to use the same dataset (HadCRU3). [SS]
101. p. 113: claim that research shows cosmic rays are important for cloud formation are not supported by the cited studies; some of the studies (Udelhofen and Cess) claimed to support relationship between cloud and cosmic rays actually refute it — [SS].
102. p. 286: claims IPCC has no evidence to support statement that glaciers are retreating – see section 4.5 in TAR for evidence — [TL].
103. p. 316: claims that 1-m sea level rise would be consistent with post- glacial rise rate, but a few sentences later says that has been dropping for the last 3000 years not rising at all. In the next paragraph he claims that rates of change of several metres per century were common during the holocene, but the references quoted actually show that 1-m changes occurred in parts of Australia and that global sea level fell steadily over the last 6000 years by a total of 2m — [SS].
104. p. 367: confused about how the earth warms. How does he think a blanket works? — [TL].
105. p. 421: claims only 4% of CO₂ in atmosphere is from humans — [TL].
106. p. 472: claims Pinatubo emitted as much CO₂ as humans in one year. no citation. Actual data shows CO₂ growth rate declined after Pinatubo eruption — [TL].

Conduct of science

This section and the following section are split off in response to critics of early versions of this document, who felt that this sort of thing dilutes the arguments about science. Misrepresent-

tations of the operation of the IPCC and the authorship of its reports are included here, while misrepresentation of the content of IPCC reports is in the main section.

107. p. 14: Hypotheses are invalidated by just one item of contrary evidence ... yes but only once it has been ascertained that the contrary evidence is being correctly interpreted.
108. p. 15: Studies of the Earth's atmosphere tell us nothing about future climate — so much for Plimer's claim that an inclusive approach is needed.
109. p. 15: Collection of new scientific data by observation, measurement and experiment is now out of fashion — patently ridiculous, given NASA budget, NOAA, CMAR, EU CarboEurope etc.
110. p. 15: Aristotle's principle quoted as First we must seek the facts, then seek to explain is one view — it contrasts to Charles Darwin's view that *a fact is of no value unless it is for or against some theory* [approximate wording].
111. p. 25, footnote 25: Given Plimer's past interactions with religious groups, choosing the Washington Times as a source of his climate data seems strange.
112. p. 112: IPCC computers don't do clouds — totally unsurprising — IPCC computers don't do climate modelling — presumably they do things like e-mail, desktop publishing, accounting etc. The climate modelling used by the IPCC is done by major research groups using models that do include clouds — see item 53.
113. p. 437: Item 84 notes misrepresentation of the authorship of WG1 chapter 5 in the IPCC AR4 as well as misrepresentation of content.
114. p. 444: The IPCC claims that its reports are written by 2500 scientists. In fact they are written by 35 who are controlled by an even smaller number. As described in page 28 the IPCC gives specific directions as to who should be acknowledged as the authors. This is far fewer than 2500 people — the IPCC reports make no such claim as 2500. However, these acknowledged authors total far more than 35 people. The 'control' is unspecified. The real control on IPCC authors is the knowledge that their work will be widely read by scientific peers and that any errors will be widely publicised. — [also in TL list].
115. p. 445 the growth of the global warming industry has replaced the collection of primary field data, measurement and experiment. — essentially a repeat of the risible claim noted in item 109.
116. p. 454: On the subject of tide data: it is hard to market a publication to a journal editor on the basis that nothing has happened. The one time that a 'nothing happened' result is readily 'marketable' is when there is a wide-spread expectation that something would happen. The Michelson-Morley experiment (failure to detect Earth's motion through the ether) is a famous example. If the tide-gauge data really cast significant doubt on the mainstream view of human-induced climate change, then publication would be much easier.

117. p. 454: No scientific journal today would have published a paper submitted by an unknown patent clerk on a fundamental breathtaking new concept of physics. Einstein did have a few things going for him, beyond being an unknown patent clerk when he submitted his paper on relativity:
- i:** he had several papers previously published;
 - ii:** much of the mathematics already existed — Einstein’s great insight was to understand what it meant. Indeed so much of the mathematics already existed that (a) the equations still carry the name ‘Lorentz transformations’; (b) one strand of ‘Aryan Science’ argued that relativity was discovered by Lorentz rather than the Jewish Einstein (although the more common ‘Aryan Science’ view was to dismiss relativity as ‘Jewish superstition’);
 - iii:** Einstein had under simultaneous consideration a paper on the photo-electric effect that appeared less confronting, but of a quality that gained Einstein the Nobel Prize in physics.²¹
118. p. 454: Some 50 or 100 years ago, great science breakthroughs were common events. Not so today. This seems to ignore the sequencing of the genome of *homo sapiens* (and other species); discovery of a new state of matter (the Bose-Einstein condensate); discovery of extra-solar planets; cloning mammals; new allotropes of carbon (buckey-balls etc.) and the proof of Fermat’s last theorem.

Some silly stuff

119. p. 20: [on IPCC authors, apparently meaning the ‘contributing authors’] Some of them used their given name in one part, used an initial in another part and an abbreviation in another. Apart from the incorrect assertion that these people ‘used’ their names (it was the lead authors — those who wrote the chapters — or the editors, who would ‘use’ the names of contributors), this sort of ambiguity is extremely common. For example, the book *Heaven + Earth* by **Ian** Plimer, cites as a reference the book *A Short History of Planet Earth* by one **I.R.** Plimer — [footnotes 564 and 2202].
120. p. 83, footnote 345: Deducing climate trends from paintings of clouds is fraught with problems (and essentially restricted to Europe). Previous studies of cloud paintings have analysed fractal dimension to show bias in representation — painters choose ‘interesting’ clouds, reflecting what Plimer notes as the role of artistic license. Also fashions change. Turner’s Val d’Aosta would probably not have been painted in an earlier time and prior to Mark Rothko and like-minded artists, a painting of marine stratus would be unlikely to have been regarded as art.
121. p. 362–363: The story of ‘Graham bank’ the volcanic island that rose and sank adds nothing to the argument. The claim The rock is worth nothing, is of no use as a territorial possession... is questionable. Territorial possession of various small outcrops around the world is asserted as the basis of exclusive economic zones, e.g. for fishing and oil extraction — [PW].

²¹The ‘less confronting’ was only appearance — what followed from work such as Einstein’s analysis of the photo-electric effect was so weird that Einstein never fully accepted it.

122. p. 464: *Giordano Bruno was burned at the stake for supporting the Copernican theory of a Sun-centred universe.* This one is trotted out from time to time by those who try to claim that rejection of their claims represents prejudice rather than reasoned arguments. An article, *The Copernican Myths*, in the December 2007 of *Physics Today* notes that Bruno was condemned mainly for theological heresies. The follow-up correspondence in *Physics Today* captured more of the complexity of the myths of science vs. religion, containing the hint that the myths were fostered by Catholics and Protestants each trying to paint the other side as the ‘bad guys’.
123. p. 467: *The environmental religion has no music ...* — how could anyone forget about Peter Garrett??
124. p. 468: *Self-denial and a return to the past led to the 600-year Dark Ages. . .* — a remarkable assertion of human influence on climate?

Other critiques

- The book review *No Science in Plimer’s Primer* by Michael Ashley picks up on issues such as the temperature data, CO₂ measurements and in particular some of Plimer’s weirder claims about the composition of the Sun, (page 116). I have noted some such issues on CO₂ measurements as items 70, 71, 72 and 74 — see also index. The index also indicates various issues regarding temperature data.
- Professor Kurt Lambeck, president of the Australian Academy of Science was interviewed on *Ockham’s Razor* on 7 June 2009. Transcript at:
<http://www.abc.net.au/rn/ockhamsrazor/stories/2009/2589206.htm>
- From Tim Lambert: *I cross referenced Ian’s list of 33 problems [i.e. version 1 of the present document] with my own list of 59 and there were only 5 things in common. So I can estimate the total number of errors if I assume that we have produced independent samples from the population of Plimer errors: (33x59)/5 = 390 problems. Almost one for every page! Blogged at:*
http://scienceblogs.com/deltoid/2009/05/ian_enting_is_checking_plimers.php

As well as 5 being a small sample, there are a lot of reasons why the samples are **not** independent — some would lead to lower estimates, some to higher estimates. There are additional comments by Tim and myself on Tim’s blog, but the bottom line is not to take the number seriously. (Of course after version 1.2, the lists stop being independent.)

Additional information

The *RealClimate* website provides links to various critiques of *Heaven + Earth*.

http://www.realclimate.org/wiki/index.php?title=Ian_Plimer

Temperature data

Normal practice, appropriate for a scrupulous and scholarly analysis, is to reference the original sources of data that are used. One reason for this is to simplify the process of checking — facilitating the usual and genuine scepticism in science. The other reason is to ensure that those who did the real work get the credit. This is becoming increasingly important as computer-generated metrics are increasingly applied to decisions on funding and career advancement.

Several of the analyses in this document use data downloaded from:

<http://www.cru.uea.ac.uk/cru/data/temperature/>

- file hadcru3gl.txt, downloaded 1/6/2009, is monthly global mean temperature anomalies.

The website from which the data were downloaded indicates that the appropriate scientific citations for these data are:

- Brohan, P., J.J. Kennedy, I. Harris, S.F.B. Tett and P.D. Jones, 2006: Uncertainty estimates in regional and global observed temperature changes: a new dataset from 1850. *J. Geophysical Research* **111**, D12106, doi:10.1029/2005JD006548 — Available as PDF.
- Jones, P.D., New, M., Parker, D.E., Martin, S. and Rigor, I.G., 1999: Surface air temperature and its variations over the last 150 years. *Reviews of Geophysics* **37**, 173-199.
- Rayner, N.A., P. Brohan, D.E. Parker, C.K. Folland, J.J. Kennedy, M. Vanicek, T. Ansell and S.F.B. Tett, 2006: Improved analyses of changes and uncertainties in marine temperature measured in situ since the mid-nineteenth century: the HadSST2 dataset. *J. Climate*, **19**, 446-469.
- Rayner, N.A., Parker, D.E., Horton, E.B., Folland, C.K., Alexander, L.V, Rowell, D.P., Kent, E.C. and Kaplan, A., 2003: Globally complete analyses of sea surface temperature, sea ice and night marine air temperature, 1871-2000. *J. Geophysical Research* **108**, 4407, doi:10.1029/2002JD002670.

Climate sensitivity

The climate sensitivity is defined as the amount of equilibrium warming caused by a doubling of CO₂ (or equivalent change in radiative forcing). Over the concentration range of most interest, this relation can be approximated as a logarithmic function (as Plimer acknowledges on page 338). Thus about the same warming is expected for doubling from 200 ppm to 400 ppm as from 300 ppm to 600 ppm. Denoting the climate sensitivity as X , means that the temperature change as a function of concentration change from C_1 to C_2 can be written as:

$$\Delta T_{1,2} = T(C_2) - T(C_1) = X[\log_2(C_2) - \log_2(C_1)] = X \times \log_2(C_2/C_1)$$

This logarithmic relation has been known since the time of Arrhenius (1896) (who estimated $X=5^\circ\text{C}$). It can be written in terms of natural logarithms (logarithms to base e) as

$$\Delta T_{1,2} = X[\log_e(C_2) - \log_e(C_1)] \times \log_2 e \approx 1.44X \times \log_e(C_2/C_1) = 1.44X \times \ln(C_2/C_1)$$

The IPCC has given a range of 1.5°C to 4.5°C. James Hansen (e.g. Bjerknes lecture at AGU fall meeting) estimates $X = 3.0 \pm 0.5^\circ\text{C}$. The logarithmic relation won't apply at low concentrations — a linear dependence is expected. The logarithmic dependence will also break down at sufficiently high concentrations.

Plimer's treatment of this lacks consistency. On a number of occasions he claims 0.5°C (e.g. page 488), while on page 426 (see item 83) he claims 1.5°C, and his example above (see item 99) of 7°C for 20 times CO₂ implies 1.61°C. (Note that since a division of logarithms is involved, the result of the calculation $7 \times \log(2.0)/\log(20.0)$ does not depend on what base is used for the logarithms, as long as the same base is used in both cases).

For a fixed initial concentration C_1 , one can look at how much the temperature increases for each unit increase in the concentration, C_2 :

$$\frac{\partial}{\partial C_2} T_2 = \frac{1.44X}{C_2}$$

This will have units of degrees C per unit of CO₂. Plimer's plot in figure 50 (page 375) which lacks any supporting citation, seems to reflect this (remembering that the $\frac{\partial T}{\partial C} \propto 1/C$ relation won't apply at low concentrations) with:

- taking the CO₂ unit as 20 ppm jumps as implied by the bars (i.e. the plot is of temperature increase for each extra 20 ppm CO₂);
- assuming that $X = 0.5^\circ\text{C}$;
- incorrectly omitting the factor of 1.44 (i.e. $\log_2 e$) that comes from going from base-2 to base- e logarithms.

Accuracy Precision and Standards

All scientific measurements are subject to error. Even when an instrument repeatedly measures the same object or sample, the results will not all be the same. For example Bischof (footnote 2094) reported a precision of ± 3 ppm for measurements of CO₂ made by the chemical method. In contrast using the Infra-Red Gas Analyser (IRGA), they found a precision of ± 1 ppm for measurements of CO₂.

While precision quantifies the measurement-to-measurement repeatability, a serious concern for any measurement is the question of 'accuracy'. Do all the measurements exhibit a systematic bias, such that the (average) measured value differs from the true value of what is meant to be measured?

Many measurements actually involve comparison of a sample to a standard. Consequently the accuracy of such a measurement is tied to the accuracy of the standard. Thus when Bischof switched to using the more precise IRGA method, he could cross-calibrate with the chemical method. (Averaging multiple chemical measurements of the standard will overcome the inherently lower precision of the chemical method). Thus Bischof's agreement between chemical and IRGA measurements could be essentially guaranteed. However in producing standards for their IRGA program, Bischof's group used an independent approach bases manometric techniques — mixing gases from precisely calibrated volumes (described in the same issue of *Tellus*

as Bischof's paper). Bischof's ability to merge results from the two techniques represents a validation of the type that Plimer claims did not exist. The independent check on the accuracy is provided by the agreement of the Bischof's higher altitude results [see footnote 2095] and Keeling's results from Mauna Loa — both indicating about 315 ppm. Keeling also prepared his standards using manometric techniques.

The 'Hockey Stick'

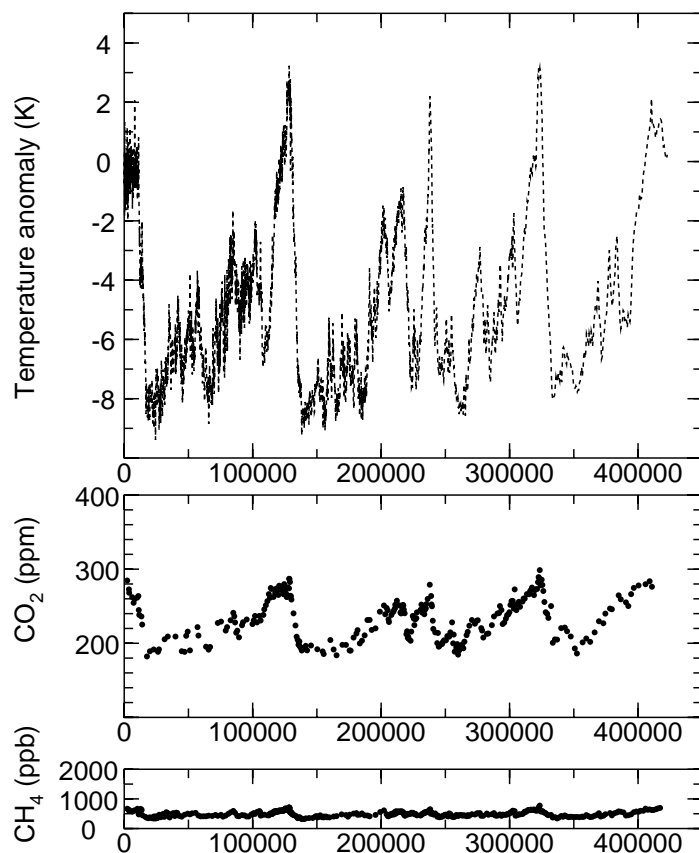
The term 'hockey stick' refers to the climate reconstruction, produced by Michael Mann and colleagues and featured in the 2001 IPCC report. This was criticised by McIntyre and McKittrick on methodological grounds. In response to requests from US legislators the 'hockey stick' analysis was reviewed by two expert panels. Although considerable partisanship was involved in establishing the panels, the core mathematical conclusions of the panels are essentially the same.

For the most part, my criticisms of *Heaven + Earth* will address the issue of whether Plimer has exaggerated the conclusions of the more critical of the reports, i.e. the Wegman report.

Plimer usually settles for describing the 'hockey stick' as *infamous*. However, on a number of occasions he explicitly describes it a *fraud*, a charge not sustained by either of the expert reviews. Plimer's claim that the IPCC knowingly included results that were known to be wrong, is disproved by comparing his account on page 91 with what is actually in the IPCC reports [see item 26].

The Vostok ice core

The diagram (from *Twisted ..*) shows the measured CO₂ and CH₄ concentrations measured from air bubbles trapped in the Vostok ice core, along with temperatures estimated from the isotopic composition of the ice.²²



Temperatures, CO₂ concentrations and methane concentrations from the Vostok ice core. The horizontal axes are in years before present. Graphic from *Twisted: The Distorted Mathematics of Greenhouse Denial* (figure 27). The vertical scales of the concentration curves are in approximate proportion to the amount of warming expected from each gas in the absence of feedbacks between climate and gas concentrations. These should be taken as indicative — the main uncertainties are in the value of the climate sensitivity used to scale the curves and the global representativeness of the estimated temperatures.

The abstract of 1987 paper on this data (back when the analysis only reached back to the previous interglacial) said *Vostok climate and CO₂ records suggest that CO₂ changes have had an important climatic role during the late Pleistocene in amplifying the relatively weak orbital*

²²Petit, J.R., et al., 2001, Vostok Ice Core Data for 420,000 Years, IGBP PAGES/World Data Center for Paleoclimatology (NOAA/NGDC Paleoclimatology Program, Boulder CO, USA). Data Contribution Series #2001-076. <http://www.ncdc.noaa.gov/paleo/icecore/antarctica/vostok/vostok.html>

forcing. The existence of the 100-kyr cycle and the synchronism between Northern and Southern Hemisphere climates may have their origin in the large glacial-interglacial CO₂ changes. [Genthon et al., *Nature*, **329**, 414–418 (1987)].

This interpretation essentially reflects the mainstream climate science interpretation over the ensuing decades: the climate CO₂ connection is that of a feedback loop with CO₂ changes **amplifying** the effects of changes in insolation due to orbital changes. The reasons for regarding this as a two-way interaction rather than direct causality in either direction are:

Why CO₂ changes are not the sole cause of ice ages:

i: The gas changes are too small. In preparing the diagram for *Twisted...* I followed a suggestion from the *RealClimate* website and plotted the concentration curves in proportion to the expected temperature changes.

ii: There are no plausible mechanisms for linking concentrations to orbital changes, except via climate changes.

Why orbital changes are not the sole cause of ice ages::

iii: The changes in insolation are too small:

iv: Many of the insolation changes act with opposite signs in the two hemispheres and so the approximate hemispheric synchronisation is hard to account for except through an amplifying factor (such as greenhouse gas concentrations) that is common to both hemispheres.

Thus having concentration changes lag behind temperature is entirely to be expected under this mainstream view, while the opposite result would have been extremely difficult to account for.

In addition to the reasons noted above:

v: the abrupt nature of the deglaciation, unlike the smooth variations in orbital forcing, points to ‘tipping point’ behaviour characteristic of a non-linear coupled system.

Al Gore’s book largely ducks the issue and calls the relation *complicated*.²³

The IPCC

Plimer’s overall approach to the IPCC reports is one of “shoot the messenger”. This attack involves extensive misrepresentation of the content of the IPCC reports [items 9, 10, 23, 26, 74, 78, 80, 84, 85, 86, 92].

One aspect of the IPCC reports that Plimer repeatedly misrepresents is the authorship of the chapters. The IPCC’s instructions on how chapters should be cited give a specific definition of authorship, i.e. those who should get the credit (or take the blame) for what is in the chapter and who are responsible for addressing review comments. These are those people listed as ‘lead authors’ and ‘convening lead authors’. These people are characterised by Plimer as scientists and environmental extremists [page 98] without actually naming any people in the latter category.

²³In the interests of precision and ability to check issues, I mainly work with the book version of *An Inconvenient Truth*. My recollection is that the content of the book (i.e. excluding the preface) and film are very similar apart from the film’s early line *I used to be “The next president of the United States”*.

Summing up

Ian Plimer's claim that the human influence on climate can be ignored, relative to natural variations seems to rest on three main strands of argument:

- a:** the extent of natural variability is larger than considered in 'mainstream' analyses;
- b:** the effects of changes in radiative forcing are smaller than values used in 'mainstream' analyses;
- c:** the IPCC uses a range of misrepresentations to conceal points **a** and **b**.

The most obvious point to note is that if there was a valid case to be made for any of these claims, then there would have been no need for Plimer to resort to systematic misrepresentation.

a: The extent of natural variability is being misrepresented, particularly through an exaggerated emphasis on the Medieval Warm Period (MWP). The cited references for large-scale Medieval warming fail to support the claim and in several of these cases seem not to mention Medieval warming at all — [items 19, 20, 97]. The one reference that seems most relevant to global-scale changes (at least over land) is the paper on the borehole data [footnote 256]. The quote from this paper is selective and inaccurate [see item 21]. The main results of the paper indicate MWP temperatures higher by 0.1 to 0.5°C, rather than the 2 to 3°C claimed by Plimer [item 21].

b: The effect of radiative forcing is being misrepresented by repeated claims of a climate sensitivity of 0.5°C [items 54, 58, 94] even when Plimer's own examples show climate sensitivities of 1.5°C to 1.6°C [item 83], his denial of an effect beyond 400 ppm [items 59, 60] even when he acknowledges the logarithmic relation [page 338] and presents a graph [figure 50] consistent with that relation [item 60].

The human contribution to changes in the Earth's radiation balance are extensively misrepresented through misrepresentation of CO₂ measurements and misrepresentation of carbon exchanges.

c: For the IPCC there is extensive misrepresentation of:

- the content of the IPCC reports [items 9, 10, 23, 26, 74, 78, 80, 84, 85, 86, 92];
- the operation of the IPCC assessment process and the authorship of reports [items 112, 84]; and
- the characteristics of climate models that form the basis of some of the science presented in the IPCC reports [items 41, 53, 95].

In support of these three main strands of argument are presented extensive references, many of which either fail to support the claims [items 19, 20, 21, 36, 38, 71, 97]; explicitly contradict the claims [items 61, 62, 66, 80]; are irrelevant to the claims [items 64, 90]; or otherwise misrepresent the cited reference.

In addition the various misrepresentations of the IPCC and the content of IPCC reports in *Heaven + Earth*, the introduction above noted:

- it has numerous internal inconsistencies [items 52, 79] as well as the inconsistencies noted above regarding climate sensitivity;
- in spite of the extensive referencing, key data are unattributed, particularly for the graphics, and the content of references is often mis-quoted [items 38, 66]. Simply citing entire books (or entire IPCC reports) for a specific point, without giving section or page numbers does not reflect a well-referenced book.

Acronyms and abbreviations

AR4 Fourth Assessment Report (of the IPCC).

BP Before present.

CDIAC Carbon Dioxide Information and Analysis Center. (Oak Ridge, USA).

GISS Goddard Institute for Space Studies.

GC Gas chromatograph(y). An instrument/technique used to measure greenhouse gases (and many other things).

GGWS The Great Global Warming Swindle.

GtC Gigatonnes of carbon. One gigatonne is one billion (10^9) tonnes.

IPCC Intergovernmental Panel on Climate Change.

IRGA Infra-red gas analyser.

LIA Little Ice Age.

MWP Medieval Warm Period.

NASA National Aeronautics and Space Administration. (USA).

NOAA National Oceanic and Atmospheric Administration (USA).

SAR Second Assessment Report (of the IPCC).

SPM Summary of Policy Makers, i.e. summary of an IPCC report.

TAR Third Assessment Report (of the IPCC).

WDCGG World Data Centre for Greenhouse Gases. (JMA, Japan).

WG1 Working Group 1 (of the IPCC).

Acknowledgements

This analysis draws on the work of various colleagues. Many errors in *Heaven + Earth* were brought to my attention by Barry Brook, Barrie Pittock, Michael Ashley, Tim Lambert, Steven Sherwood, David Karoly and Penny Whetton. This input is acknowledged by initials after various items. Generally this does not cover cases where several of us have independently noted the same flaw. My grateful thanks for this input should not be taken as implying that they agree with every detail of how I have discussed the concerns that they identified. Item 12 includes a comment from the *Brave New Climate* website. Particular thanks are due to Richard Brak who organised a ‘re-direct’ when *The Australian* inserted an extra dash in the URL that I sent them.

Version history

Typeset June 29, 2009

The intention is that the published URL shall always refer to the most recent version of this document.

The current version is:

Version 1.9, with my itemised and indexed discussion of 99 items and a number of other contributed items giving a total of 106, still with ‘conduct of science’ and ‘silly stuff’ split off.

The various versions (with approximate times of availability) have been:

- Version 1.8 with a total of 96 ‘science’ items, with ‘conduct of science’ and ‘silly stuff’ split off: MASCOS 15:10, 9/6/2009.
- Version 1.7 with a total of 92 ‘science’ items, with ‘conduct of science’ and ‘silly stuff’ split off: MASCOS 09:00, 2/6/2009.
- Version 1.6 with a total of 77 ‘science’ items, with ‘conduct of science’ and ‘silly stuff’ split off: MASCOS 16:00, 25/5/2009.
- Version 1.5 with a total of 61 items concerning the science with additional discussions relating to conduct of science (and some silly stuff) split off from the main discussion. MASCOS 08:17, 22/5/2009.
- Version 1.4, with my itemised and indexed discussion of 46 items and other contributions bringing the total to 58 (plus comments on some silly stuff): about 18:00 on 16/5/2009 (BNC site) and about 10:40, 18/5/2009 (MASCOS).
- Version 1.3, with itemised and indexed discussion of 40 of my items and 3 other contributions: 15/5/2009 (BNC site only).

- Version 1.2, with itemised and indexed discussion of 39 items: 14/5/2009.
My letter about this document was published in *The Australian* on 15/5/2009 with the underscore character in the the URL that I sent in my letter replaced by a ‘dash’ in the printed version and a double hyphen in the electronic version. A ‘re-direct’ was established at the University of Melbourne so that the document could be accessed from the published address, but did not deal with the fact that the two forms of publication involved two different incorrect URLs. My posts to the Australian’s letters blog were not accepted.
- Version 1.1, with itemised and indexed discussion of 34 items was uploaded for test purposes about 16:30 13/5/2009, unfortunately resulting in a failed test, with the URL not being preserved (but removing version 1).
- Version 1, with itemised and indexed discussion of 33 items, was submitted to the MAS-COS website on 12/5/2009 and available from mid-morning 13/5/2009.

Due to problems on the MASCOS site and the incorrectly published links, various versions were mirrored on the *Brave New Climate* website.

- version 1.8: 01:10, 10/6/2009;
- version 1.7: 17:50, 1/6/2009;
- version 1.6: 21:30, 25/5/2009;
- version 1.5: 01:45, 22/5/2009;
- version 1.4: at about 18:10, 16/5/2009;
- version 1.3: late on evening of 15/5/2009;
- version 1.2: on 14/5/2009;
- version 1.1: from about 21:00, 13/5/2009.

Response to criticism of my analysis

A number of these criticisms come from the letters blog of *The Australian*. Since *The Australian* did not accept my posts of replies, even when I kept my comments separate from the URL issue, a few short comments are given here:

Why didn’t I attack Al Gore in the same way?

i: I wasn’t engaged in public debate until early 2007 when I started writing *Twisted: The Distorted Mathematics of Greenhouse Denial*.

ii: Plimer claims to be writing as a scientist and his op-ed *Hot-air doomsayers* (5/5/2009 in *The Australian*) challenges scientists to address the science. I am taking him at his word. As noted above, *Heaven + Earth* is being promoted as a *scrupulous and scholarly analysis*.²⁴ Gore is a politician and *An Inconvenient Truth* is largely a political book, arising from the difficulties of

²⁴From cover blurb on paperback edition, by Lord Lawson of Blaby.

responding to ‘politically-inconvenient’ science.

iii: Even if one thinks that Justice Burton was wrong and one accepts all the errors claimed in the UK court case, Gore’s book has many fewer scientific errors than *Heaven + Earth*. (This assessment was based on my own notes. Earlier versions, 1 to 1.3, did not document enough of the errors to demonstrate that claim.)

Concentrating on Plimer’s inconsistencies is nit-picking that doesn’t address scientific issues

A theme that I tried to get across is *Twisted* is that for a scientific theory, a lack of internal consistency is even more fatal than discordant observations. Thus, to the extent that Plimer claims to be proposing an alternative theory²⁵, his own lack of consistency becomes an issue of science and not just an issue of editorial quality.

Checking my claims

If you can’t accept the assessments of the IPCC after all the care and detailed review, then there it would seem unlikely that you would take my word for the claims above without checking.²⁶ The selection of flaws described in this document is intended to maximise the extent to which individuals can check my claims for themselves.

Plimer’s inconsistencies: Here the only resource that you need is a copy of *Heaven + Earth*, and maybe a calculator (or a spreadsheet). This will allow you to check the claims that I make in items 25, 33, 39, 45, 52, 55, 69, 79, 81 and the various inconsistent values for climate sensitivity discussed in items 54, 58, 60, 83, 94, 99.

Other flaws: Similarly, a copy of the book is all that is need to check various graphics flaws such as axis labelling, [see item 3 for summary] and things such as items 7, 22, 27, 31, 33, 35, 40, 59 (with the aid of a good dictionary) as well as most of the things in the section on ‘Silly Stuff’ (page 22).

Plimers misrepresentation of the IPCC: Many of these are easily checked, since the full Third and Fourth Assessment Reports are available as downloads from the IPCC website. A figure such as 8.20 indicates a figure in chapter 8 (with TS indicating the Technical Summary). This will enable your to check (at least in part) items 9, 10, 11, 26, 74, 24, 80, 84, 85, 86. Checking items 23, 78 requires obtaining access to one or both of the first two assessments as do some aspects of items 26, 74, 85, 97.

Using other internet resources: Most of the data sets discussed in this document can be freely accessed.

- The various HadCRU temperature data sets are available from:
<http://www.cru.uea.ac.uk/cru/data/temperature/>
This will enable you to check items 6, 13, 65, and (with reference to IPCC report to verify my identification of the data set) 92.

²⁵as opposed to spreading doubt and confusion for political purposes

²⁶After all, I have been a lead author of an IPCC chapter.

- The plot, http://cdiac.ornl.gov/trends/co2/graphics/Mauna_Loa_CO2.jpg, from CDIAC shows that at the primary repository for these data, the gaps in the Mauna Loa data set have not somehow mysteriously disappeared — item 70.
- <http://arctic.atmos.uiuc.edu/cryosphere/IMAGES/global.daily.ice.area.withtrend.jpg> will show that the lower plot in figure 29 is not what Plimer claims [item 44].

In addition:

- <http://www.bailii.org/ew/cases/EWHC/admin/2007/2299.html> is the judgment in the UK court case on *An Inconvenient Truth*, enabling you to check item 88.

Library references: A number of Plimer's references are to books and journals that are only found in specialist libraries. However the journals *Science* and *Nature* are quite widely available.

Access to *Nature* will enable you to check references 1075 [item 38], 255 [item 20], 256 [item 21], 595 [item 34], 2056 [item 66], 2134 [item 82].

Access of *Science* will enable you to check references 595 [item 34], 1990 [item 63], 2178 [item 87].

Disclaimer

This discussion, its contents and style, are the responsibility of the author and do not represent the views, policies or opinions of The University of Melbourne.

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