Suggested Reading for Global Warming

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****Covariation of carbon dioxide and temperature from the Vostok ice core after deuterium-excess correction

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Ice-core measurements of carbon dioxide and the deuterium palaeothermometer reveal significant covariation of temperature and atmospheric CO_2 concentrations throughout the climate cycles of the past ice ages. This covariation provides compelling evidence that CO_2 is an important forcing factor for climate. But this interpretation is challenged by some substantial mismatches of the CO_2 and deuterium records, especially during the onset of the last glaciation, about 120 kyr ago. Here we incorporate measurements of deuterium excess from Vostok in the temperature reconstruction and show that much of the mismatch is an artefact caused by variations of climate in the water vapour source regions. Using a model that corrects for this effect, we derive a new estimate for the covariation of CO_2 and temperature, of r^2 = 0.89 for the past 150 kyr and r^2 = 0.84 for the period 350–150 kyr ago. Given the complexity of the biogeochemical systems involved, this close relationship strongly supports the importance of carbon dioxide as a forcing factor of climate. Our results also suggest that the mechanisms responsible for the drawdown of CO_2 may be more responsive to temperature than previously thought.

Nature (articles available online at www.nature.com)

Carbon isotope data in core V19-30 confirm reduced carbon dioxide concentration in the ice age atmosphere

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Precise and detailed measurements have been made of the ^{13}C content of both planktonic and benthic foraminifera in core V 19-30. Using the approach developed by Broecker, a record of atmospheric CO_2 concentration during the past 120,000 years has been derived which provides independent confirmation that the CO_2 concentration in the glacial-age atmosphere was much lower than it is today.

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Greater global warming revealed by satellite-derived sea-surface-temperature trends

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INVESTIGATING the response of global climate to changes in external forcing is essential to our understanding of climate change. Here I present an analysis of satellite-derived sea surface temperatures for the period 1982−88. It can be seen from this analysis that the global ocean is undergoing a gradual but significant warming of ~0.1 °C per year, whereas the trend obtained for the same period from conventional data sources (ships and buoys) is about half that magnitude[1]. Satellite global coverage, however, is far greater and, although we have no long time series of satellite data (as opposed to conventional data), it is possible to observe short-term trends, as shown here, that may not be discerned using the coarser-resolution conventional data.

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Future global warming from atmospheric trace gases

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Human activity this century has increased the concentrations of atmospheric trace gases, which in turn has elevated global surface temperatures by blocking the escape of thermal infrared radiation. Natural climate variations are masking this temperature increase, but further additions of trace gases during the next 65 years could double or even quadruple the present effects, causing the global average temperature to rise by at least 1 °C and possibly by more than 5 °C. If the rise continues into the twenty-second century, the global average temperature may reach higher values than have occurred in the past 10 million years.

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Radiocarbon evidence for a smaller oceanic carbon dioxide sink than previously believed

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RADIOCARBON produced naturally in the upper atmosphere or arti-ficially during nuclear weapons testing is the main tracer used to validate models of oceanic carbon cycling, in particular the exchange of carbon dioxide with the atmosphere[1–3]

and the mixing parameters within the ocean itself[4–7]. Here we test the overall consistency of exchange fluxes between all relevant compartments in a simple model of the global carbon cycle, using measurements of the long-term tropospheric CO^2 concentration[8] and radiocarbon composition[9–12], the bomb ^{14}C inventory in the stratosphere[13,14] and a compilation of bomb detonation dates and strengths[15]. We find that to balance the budget, we must invoke an extra source to account for 25% of the generally accepted uptake of bomb ^{14}C by the oceans[3]. The strength of this source decreases from 1970 onwards, with a characteristic timescale similar to that of the ocean uptake. Significant radiocarbon transport from the remote high stratosphere and significantly reduced uptake of bomb ^{14}C by the biosphere can both be ruled out by observational constraints. We therefore conclude that the global oceanic bomb ^{14}C inventory should be revised downwards. A smaller oceanic bomb 14C inventory also implies a smaller oceanic radiocarbon penetration depth[16], which in turn implies that the oceans take up 25% less anthropogenic CO_2 than had previously been believed.

Other References
Scientific American

		Dr. James E. Hansen
03/01/2004	**Defusing the Global Warming Time Bomb**	Affiliation: National Aeronautics and Space Administration

Global warming is real, and the consequences are potentially disastrous. Nevertheless, practical actions, which would also yield a cleaner, healthier atmosphere, could slow, and eventually stop, the process ..

Is Global Warming Harmful to Health?; August 2000; by Paul R. Epstein(**Paul R**. **Epstein** is associate director of the Center for Health and the Global Environment at Harvard Medical School); 8 page(s)

Today few scientists doubt the atmosphere is warming. Most also agree that the rate of heating is accelerating and that the consequences of this temperature change could become increasingly disruptive. Even high school students can reel off some projected outcomes: the oceans will warm, and glaciers will melt, causing sea levels to rise and salt water to inundate settlements along many low-lying coasts. Meanwhile the regions suitable for farming will shift. Weather patterns should also become more erratic and storms more severe.

Yet less familiar effects could be equally detrimental. Notably, computer models predict that global warming, and other climate alterations it induces, will expand the incidence and distribution of many serious medical disorders. Disturbingly, these forecasts seem to be coming true.

04/01/2004	**On Thin Ice**	**Robert A. Bindschadler** (The Laboratory for Hydrospheric Processes. NASA-Goddard Space Flight Center. Greenbelt, Maryland USA and **Charles R. Bentley Charles R**. **Bentley**. Emeritus Professor. Geophysics. University of Wisconsin)

How soon humanity will have to move inland to escape rising seas depends in great part on how quickly West Antarctica's massive ice sheet shrinks. Scientists are finally beginning to agree on what controls the size of the sheet and its rate of disintegration (originally published December 2002) .. **more**

01/01/2004	**Spring Forward**	Dan **Grossman**.

As temperatures rise sooner in spring, interdependent species in many ecosystems are shifting dangerously out of sync .. **more**

11/01/1999 **Flammable Ice** Suess, Bohrmann, Greinert, Lausch

Methane-laced ice crystals in the seafloor store more energy than all the world's fossil fuel reserves combined. But these methane hydrate deposits are fragile, and the gas that escapes from them may exacerbate global warming ..

04/01/2004 **Meltdown in the North** Matthew Sturm, Donald K. Perovich and Mark C. Serreze

Sea ice and glaciers are melting, permafrost is thawing, tundra is yielding to shrubs - and scientists are struggling to understand how these changes will affect not just the Arctic but the entire planet (originally published October 2003) ..