IPCC(1990) FAR, May 1990, extract from Chapter 7, pp.199, (200 blank), 201-203
www.ipcc.ch/publications_and_data/publications_ipcc_first_assessment_1990_wg1.shtml
Fig 7.1(c) was derived from Lamb (1965 and 1982) for **Central England**, not cited in 1990.
IPCC wrote Little Ice Age was ~global, but Medieval Warm Period was unclear, although North Atlantic region was known to be warm. Highlighted text shows the context for Fig 7.1(c).
Mis-users often fixed "years before present" but kept the erroneous caption "global."
If they actually read these pages, they misrepresented the IPCC, but many had no access to the report, which was only scanned and placed online in 2010. The applicable terms are false citation, mispresentation, **academic fraud** or perhaps serious incompetence.

EXECUTIVE SUMMARY

***** There has been a real, but irregular, increase of global surface temperature since the late nineteenth century.

***** There has been a marked, but irregular, recession of the majority of mountain glaciers over the same period.

***** Precipitation has varied greatly in sub-Saharan Africa on time scales of decades.

*** Precipitation has progressively increased in the Soviet Union over the last century.

*** A steady increase of cloudiness of a few percent has been observed since 1950 over the USA.

* A larger, more sudden, but less certain increase of cloudiness has been observed over Australia.

Observational and palaeo-climatic evidence indicates that the Earth's climate has varied in the past on time scales ranging from many millions of years down to a few years. Over the last two million years, glacial-interglacial cycles have occurred on a time scale of 100,000 years, with large changes in ice volume and sea level. During this time, average global surface temperatures appear to have varied by about 5-7°C. Since the end of the last ice age, about 10,000 BP, globally averaged surface temperatures have fluctuated over a range of up to 2°C on time scales of centuries or more. Such fluctuations include the Holocene Optimum around 5,000-6,000 years ago, the shorter Medieval Warm Period around 1000 AD (which may not have been global) and the Little Ice Age which ended only in the middle to late nineteenth century. Details are often poorly known because palaeo-climatic data are frequently sparse.

The instrumental record of surface temperatures over the land and oceans remains sparse until after the middle of the nineteenth century. It is common, therefore, to emphasize trends in the global instrumental record from the late nineteenth century. The record suggests a global (combined land and ocean) average warming of 0.45±0.15°C since the late nineteenth century, with an estimated small (less than 0.05°C) exaggeration due to urbanisation in the land component. The greater part of the global temperature increase was measured prior to the mid-1940s. Global warming is indicated by three independent data sets: air temperatures over land, air temperatures over the ocean, and sea surface temperatures. The latter two data sets show only a small lag compared with land temperatures. A marked retreat of mountain glaciers in all parts of the world since the end of the nineteenth century provides further evidence of warming.

The temperature record of the last 100 years shows significant differences in behaviour between the Northern and Southern Hemispheres. A cooling of the Northern Hemisphere occurred between the 1940s and the early 1970s, while Southern Hemisphere temperatures remained nearly constant from the 1940s to about 1970. Since 1970 in the Southern Hemisphere and 1975 in the Northern Hemisphere, a more general warming has been observed, concentrated into the period 1975-1982, with little global warming between 1982 and 1989. However, changes of surface temperature in different regions of the two hemispheres have shown considerable contrasts for periods as long as decades throughout the last century, notably in the Northern Hemisphere

Over periods as short as a few years, fluctuations of global or hemispheric temperatures of a few tenths of a degree are common. Some of these are related to the El Niño-Southern Oscillation phenomenon in the tropical Pacific. Evidence is also emerging of decadal time scale variability of ocean circulation and deep ocean heat content that is likely to be an important factor in climate change.

It is not yet possible to deduce changes in precipitation on global or even hemispheric scales. Some regions have, however, experienced real changes over the past few decades. A large decline in summer seasonal rainfall has been observed in sub-Saharan Africa since the 1950s but precipitation appears to have increased progressively over the Soviet Union during the last century.

Reliable records of sea-ice and snow are too short to discern long-term changes. Systematic changes in the number and intensity of tropical cyclones are not apparent, though fluctuations may occur on decadal time scales. There is no evidence yet of global scale changes in the frequency of extreme temperatures Increases in cloud cover have been reported from the oceans and some land areas Uncertainties in these records are mostly too large to allow firm conclusions to be drawn Some of the changes are artificial, but increases of cloudiness over the USA and Australia over the last forty years may be real.

We conclude that despite great limitations in the quantity and quality of the available historical temperature data, the evidence points consistently to a real but irregular warming over the last century. A global warming of larger size has almost certainly occurred at least once since the end of the last glaciation without any appreciable increase in greenhouse gases. Because we do not understand the reasons for these past warming events it is not yet possible to attribute a specific proportion of the recent, smaller, warming to an increase of greenhouse gases.

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7.1 Introduction

This Section focuses on changes and variations in the modern climate record To gain a longer term perspective and to provide a background to the discussion of the palaeo-analogue forecasting technique in Section 3, variations in palaeo-climate are also described Analyses of the climate record can provide important information about natural climate variations and variability A major difficulty in using observed records to make deductions about changes resulting from recent increases in greenhouse gases (Sections 1 and 2) is the existence of natural climatic forcing factors that may add to, or subtract from, such changes Unforced internal variability of the climate system will also occur further obscuring any signal induced by greenhouse gases

Observing the weather, and converting weather data to information about climate and climate change is a very complex endeavour Virtually all our information about modern climate has been derived from measurements which were designed to monitor weather rather than climate change Even greater difficulties arise with the proxy data (natural records of climate sensitive phenomena, mainly pollen remains, lake varves and ocean sediments, insect and animal remains glacier termini) which must be used to deduce the characteristics of climate before the modern instrumental period began So special attention is given to a critical discussion of the quality of the data on climate change and variability and our confidence in making deductions from these data Note that we have not made much use of several kinds of proxy data, for example tree ring data, that can provide information on climate change over the last millennium We recognise that these data have an increasing potential however their indications are not yet sufficiently easy to assess nor sufficiently integrated with indications from other data to be used in this report

A brief discussion of the basic concepts of climate climate change, climate trends etc together with references to material containing more precise definitions of terms, is found in the Introduction at the beginning of this Report

7.2 Palaeo-Climatic Variations and Change

7.2.1 Climate Of The Past 5,000,000 Years

Climate varies naturally on all time scales from hundreds of millions of years to a few years Prominent in recent Earth's history have been the 100,000 year Pleistocene glacial-interglacial cycles when climate was mostly cooler than at present (Imbrie and Imbrie 1979) This period began about 2,000,000 years before the present time (BP) and was preceded by a warmer epoch having only limited glaciation, mainly over Antarctica called the Pliocene Global surface temperatures have typically varied by 5-7 C through the Pleistocene ice age cycles with large changes in ice volume and sea level, and temperature variations as great as 10-15°C in some middle and high latitude regions of the Northern Hemisphere Since the beginning of the current interglacial epoch about 10 000 BP global temperatures have fluctuated within a much smaller range Some fluctuations have nevertheless lasted several centuries, including the Little Ice Age which ended in the nineteenth century and which was global in extent ←

Proxy data clearly indicate that the Earth emerged from the last ice age 10,000 to 15,000 BP (Figure 7 1) During this glacial period continental size ice sheets covered much of North America and Scandinavia and world sea level was about 120m below present values An important cause of the recurring glaciations is believed to be variations in seasonal radiation receipts in the Northern Hemisphere These variations are due to small changes in the distance of the Earth from the sun in given seasons and slow changes in the angle of the tilt of the Earth s axis which affects the amplitude of the seasonal insolation These Milankovitch orbital effects (Berger, 1980) appear to be correlated with the glacial-interglacial cycle since glacials arise when solar radiation is least in the extratropical Northern Hemisphere summer

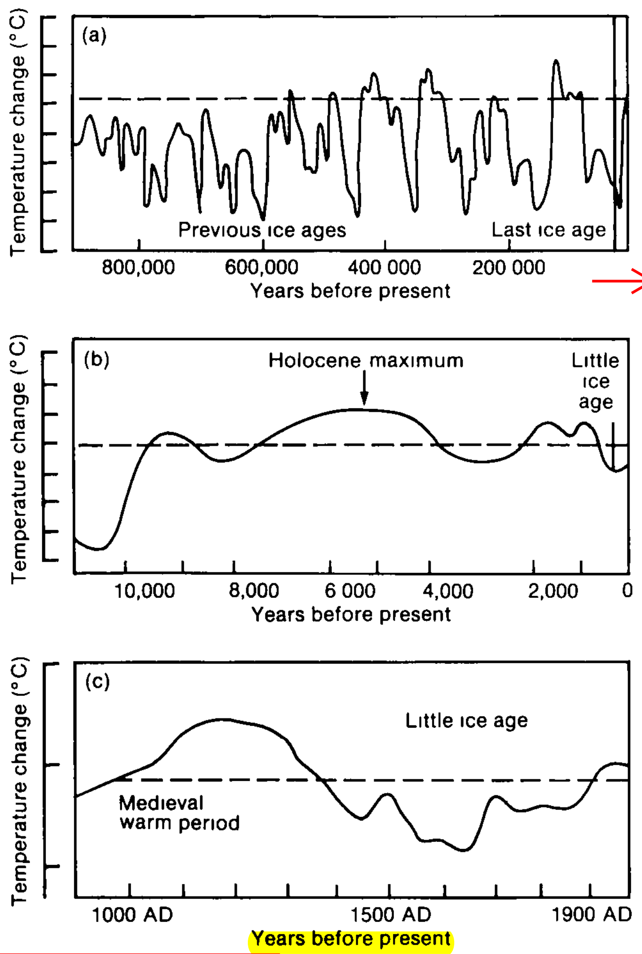
Variations in carbon dioxide and methane in ice age cycles are also very important factors, they served to modify and perhaps amplify the other forcing effects (see Section 1) However, there is evidence that rapid changes in climate have occurred on time scales of about a century which cannot be directly related to orbital forcing or to changes in atmospheric composition The most dramatic of these events was the Younger Dryas cold episode which involved an abrupt reversal of the general warming trend in progress around 10 500 BP as the last episode of continental glaciation came to a close The Younger Dryas was an event of global significance it was clearly observed in New Zealand (Salinger 1989) though its influence may not have extended to all parts of the globe (Rind et al 1986) There is as yet no consensus on the reasons for this climatic reversal which lasted about 500 years and ended very suddenly However because the signal was strongest around the North Atlantic Ocean suggestions have been made that the climatic reversal had its physical origin in large changes in the sea surface temperature (SST) of the North Atlantic Ocean One possibility is that the cooling may have resulted from reduced deep water production in the North Atlantic following large scale melting of the Laurentide Ice sheet and the resulting influx of huge amounts of low density freshwater into the northern North Atlantic ocean (Broecker et al 1985) Consequential changes in the global oceanic circulation may have occurred (Street Perrott and Perrott 1990) which may have involved variations in the strength of the thermohaline

IPCC was chartered in late 1988, got organized and produced this ~1.5 years later, not usual 6-year cycle.

circulation in the Atlantic This closed oceanic circulation involves northward flow of water near the ocean surface sinking in the sub-Arctic and a return flow at depth The relevance of the Younger Dryas to today's conditions is that it is possible that changes in the thermohaline circulation of a qualitatively similar character might occur quite quickly during a warming of the climate induced by greenhouse gases A possible trigger might be an increase of precipitation over the extratropical North Atlantic (Broecker, 1987), though the changes in ocean circulation are most likely to be considerably smaller than in the Younger Dryas Section 6 gives further details

The period since the end of the last glaciation has been characterized by small changes in global average temperature with a range of probably less than 2°C (Figure 7 1), though it is still not clear whether all the fluctuations indicated were truly global However, large regional

Lack of source was a bit sloppy, this was clearly done in relative hurry.



Error often fixed to Years AD

Error ignored

Figure 7.1: Schematic diagrams of global temperature variations since the Pleistocene on three time scales (a) the last million years (b) the last ten thousand years and (c) the last thousand years The dotted line nominally represents conditions near the beginning of the twentieth century

changes in hydrological conditions have occurred, particularly in the tropics Wetter conditions in the Sahara from 12 000 to 4,000 years BP enabled cultural groups to survive by hunting and fishing in what are today almost the most arid regions on Earth During this time Lake Chad expanded to become as large as the Caspian Sea is today (several hundred thousand km^2, Grove and Warren, 1968) Drier conditions became established after 4,000 BP and many former lake basins became completely dry (Street-Perrot and Harrison 1985) Pollen sequences from lake beds of northwest India suggest that periods with subdued monsoon activity existed during the recent glacial maximum (Singh et al 1974) but the epoch 8,000 to 2,500 BP experienced a humid climate with frequent floods

There is growing evidence that worldwide temperatures were higher than at present during the mid-Holocene (especially 5 000-6 000 BP), at least in summer, though carbon dioxide levels appear to have been quite similar to those of the pre-industrial era at this time (Section 1) Thus parts of western Europe China, Japan, the eastern USA were a few degrees warmer in July during the mid-Holocene than in recent decades (Yoshino and Urushibara, 1978, Webb et al 1987, Huntley and Prentice, 1988, Zhang and Wang 1990) Parts of Australasia and Chile were also warmer The late tenth to early thirteenth centuries (about AD 950-1250) appear to have been exceptionally warm in western Europe, Iceland and Greenland (Alexandre 1987, Lamb, 1988) This period is known as the Medieval Climatic Optimum China was, however, cold at this time (mainly in winter) but South Japan was warm (Yoshino, 1978) This period of widespread warmth is notable in that there is no evidence that it was accompanied by an increase of greenhouse gases

Cooler episodes have been associated with glacial advances in alpine regions of the world, such 'neo-glacial' episodes have been increasingly common in the last few thousand years Of particular interest is the most recent cold event, the 'Little Ice Age', which resulted in extensive glacial advances in almost all alpine regions of the world between 150 and 450 years ago (Grove, 1988) so that glaciers were more extensive 100-200 years ago than now nearly everywhere (Figure 7 2) Although not a period of continuously cold climate, the Little Ice Age was probably the coolest and most globally extensive cool period since the Younger Dryas In a few regions, alpine glaciers advanced down-valley even further than during the last glaciation (for example, Miller, 1976) Some have argued that an increase in explosive volcanism was responsible for the coolness (for example Hammer, 1977, Porter, 1986), others claim a connection between glacier advances and reductions in solar activity (Wigley and Kelly, 1989) such as the Maunder and Sporer solar activity minima (Eddy, 1976), but see also Pittock (1983) At present, there is no

Evidence of moderate rise came years later, via Law Dome.
http://oi56.tinypic.com/2hq8k1z.jpg
ftp://ftp.ncdc.noaa.gov/pub/data/paleo/icecore/antarctica/law/law_co2.txt

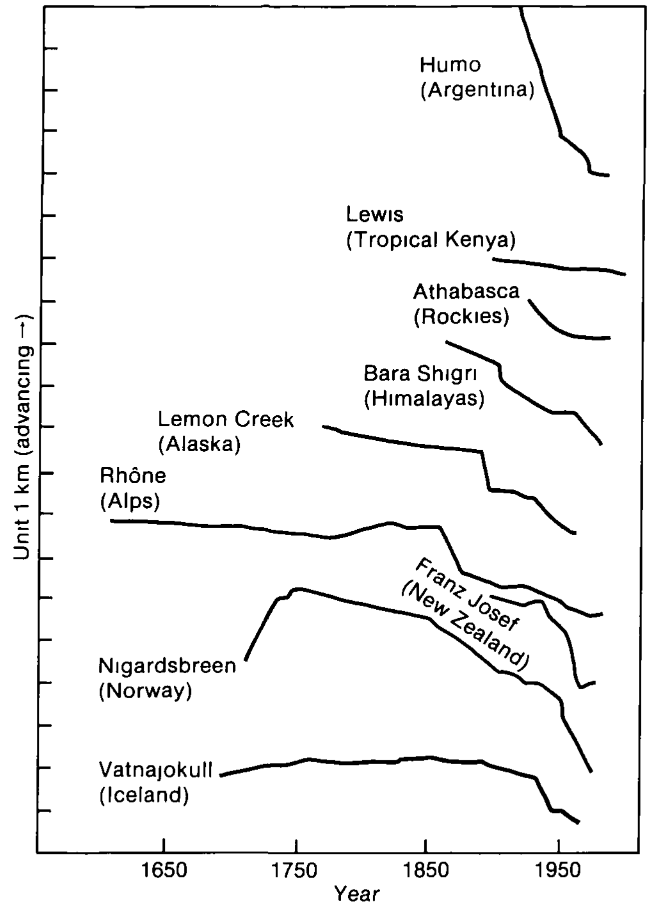


Figure 7.2: Worldwide glacier termini fluctuations over the last three centuries (after Grove, 1988, and other sources)

agreed explanation for these recurrent cooler episodes The Little Ice Age came to an end only in the nineteenth century Thus some of the global warming since 1850 could be a recovery from the Little Ice Age rather than a direct result of human activities So it is important to recognise that natural variations of climate are appreciable and will modulate any future changes induced by man

7.2.2 *Palaeo-Climate Analogues from Three Warm Epochs*

Three periods from the past have been suggested by Budyko and Izrael (1987) as analogues of a future warm climate For the second and third periods listed below, however, it can be argued that the changed seasonal distribution of incoming solar radiation existing at those times may not necessarily have produced the same climate as would result from a globally-averaged increase in greenhouse gases

1) The climate optimum of the Pliocene (about 3,300,000 to 4,300,000 years BP)
2) The Eemian interglacial optimum (125,000 to 130,000 years BP),
3) The mid-Holocene (5,000 to 6,000 years BP)

Note that the word optimum" is used here for convenience and is taken to imply a warm climate However such a climate may not be "optimal" in all senses

7 2 2 1 Pliocene climatic optimum (about 3,300,000 to 4,300,000 BP)

Reconstructions of summer and winter mean temperatures and total annual precipitation have been made for this

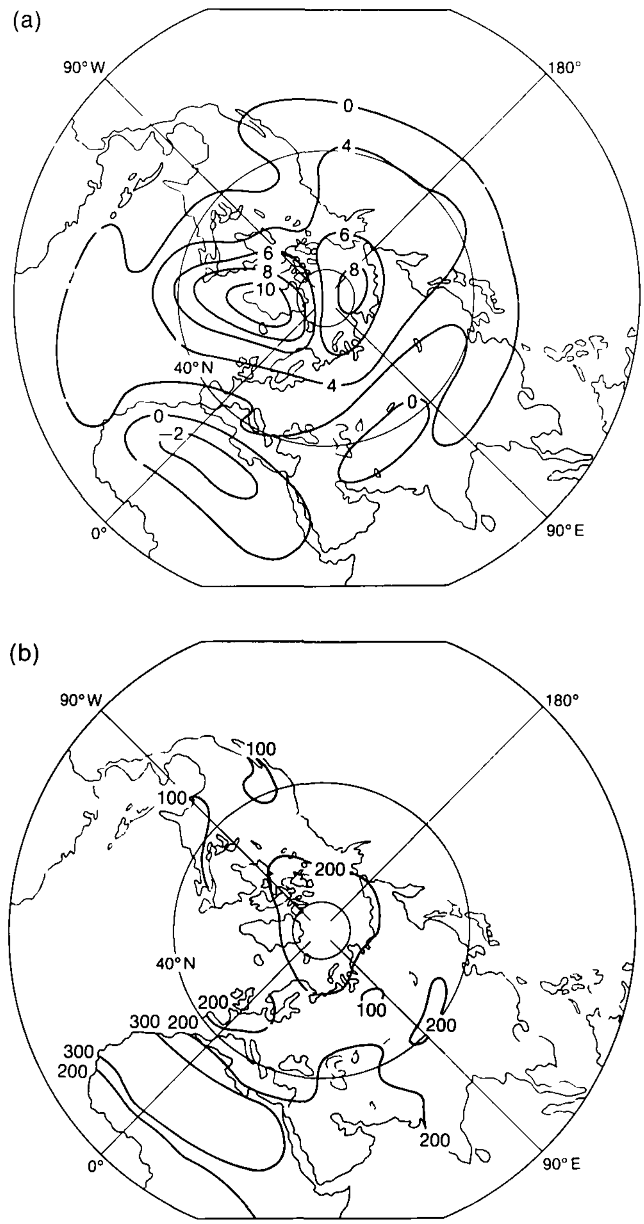


Figure 7.3: (a) Departures of summer air temperature (°C) from modern values for the Pliocene climatic optimum (4 3 to 3 3 million years BP) (from Budyko and Izrael 1987)
(b) Departures of annual precipitation (mm) from modern values for the Pliocene climatic optimum (from Budyko and Izrael 1987 Peshy and Velichko 1990)