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What climate models really show about global warming

Greenhouse "experts" point to the fact that temperature has risen over 100 years, and that six of the hottest years have been in the last decade, to prove their claims. Part 2 of Gerd Weber's report.

We continue our slightly abridged serialization of Chapters 3 and 4 of Gerd R. Weber's forthcoming English-language book Global Warming, The Rest of the Story, *which first appeared in German under the title* Treibhauseffekt: Klimakatastrophe oder Medienpsychose? *(Wiesbaden: Böttiger Verlags-GmbH, 1991).*

In Part 1 last week, Weber set right some of the most prevalent misconceptions about the greenhouse effect and "climate change." Weber defines climate as "the average state of the atmosphere and of such parameters as temperature or precipitation, [and] also the variability and range of those parameters over an extended period of time . . . usually 30 years." From that standpoint, Weber then begins a critical look at the different computer models that predict global warming based on a doubling of carbon dioxide, or the equivalent in trace-gases, SO_2, methane, and chlorofluorocarbons. Part 2 continues that examination.

For reasons of space, we are not able to reproduce all of the graphics, and for clarity, they are numbered consecutively as they appear here.

If you stuck your head out the window, would you not see it?

Since we are now in the middle of "what if" wonderland, i.e., what happens if climate model forecasts are right, we will now consider—in passing—how human beings might perceive such a drastic temperature increase.

The field in meteorology concerned with the impact of weather and climate on man and his health is called biometeorology. In biometeorology, several indices have been developed which attempt, one way or another, to measure "climatic stress" on human beings. Usually this is done by selecting a base temperature at which most people appear to be comfortable (there may be some argument as to what such a temperature might be) and then, for a given location, adding up the departures from that temperature in terms of either hourly, daily or monthly values. One example for this procedure is the heating/cooling degree-day-index. Here, a base temperature of 65°F is chosen and the sums of the fluctuations of daily average temperatures above 65° are cooling degree days and those below are heating degree days.

In addition, human beings usually do not respond to temperature stress in a linear fashion, but rather feel disproportionally stressed the more the actual temperature moves away from the temperature they feel most comfortable at. This phenomenon is often accounted for by letting the temperature stress increase with the square of the temperature difference to the "comfortable temperature."

Example: Let us assume you feel comfortable at 70°F. Then at 50°, 20° lower, you would get somewhat uncomfortable, but at 30°, another 20° lower, you would not simply be twice as uncomfortable, but four times as uncomfortable and freeze tremendously if you were unprotected, not to mention what would happen at 10°F, wind-chill factor excluded.

One such example of a comfort index is presented in **Figure 1.** It shows in relative units, the level of comfort you—or an average person—would experience under the presently observed climate at any given location on the map. The scaling is such that the higher the numerical value, the more comfortable you feel. If we now take up the examples we used before, and let Chicago have the climate of Nashville, that would result in an overall increase in comfort almost entirely due to the milder winters.

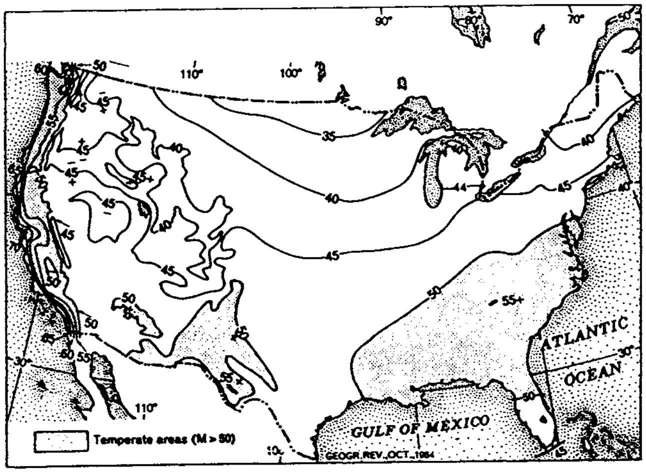
If, on the other hand, we let New Orleans have the climate of Miami, we would decrease the comfort there almost entirely due to the hotter, unbearable summers.

We realize, then, that climate change, if it progresses the way the models predict, is a mixed bag indeed, since it appears that people in the southern states will on average suffer under this change, whereas people in the northern states will

FIGURE 1

Geographical distribution of a climate stress index over the United States

Temperate areas (M>50)



Source: *Global Warming, the Rest of the Story*, R.E. Munn, Biometeorological Methods, 1970.

actually feel more comfortable in the warmer climate of the future. It may be noted that no allowance for humidity has yet been made here. If this is done, as it should be, the pattern is liable to change somewhat.

Let us instead direct our attention to four specific items related to the climate change issue which frequently come up in public debate, and which are most commonly cited when it comes to describing the negative impacts of global warming: 1) the shifting of climatic zones; 2) the melting of polar ice caps; 3) rising sea levels and inundation of coastal lowlands; 4) increasing frequency and severity of droughts in the American corn belt.

At this point we will *only* be concerned with the question of whether or not these impacts can be deduced from current best available model predictions, but we will *not* be concerned (yet) with the question of whether we can already see any such effects or really have to expect them. What we are trying to do, then, at this point is determine whether there is any basis in model predictions for the horror stories one hears so much about in the media, or if some of the model results got lost or altered in the process of transmission from the scientific community to the media.

1) The shifting of climatic zones

Life on Earth is adapted to the way climatic zones are arranged. The position of those climatic zones is determined by the large-scale atmospheric circulation: The tropical zones along and within some distance of the equator with their frequent and abundant rainfall, the trade wind region, the subtropical high pressure belt with hyperarid regions, such as the Sahara Desert, at a distance of roughly 30° latitude, followed, toward the poles, by the prevailing westerlies, in which most of the U.S. is located, and in which low pressure systems track eastward, guided by the polar jet stream at about 50°.

The position of the main features of the general circulation is determined first of all by Earth's rate of rotation; second, by the temperature contrast between equator and pole; and third, by the distribution of land and sea on Earth.

Notably the location of the subtropical jet stream, which governs the position of the subtropical high pressure belts and therefore the arid zones, but also the location of the polar jet, which is much more variable, and determines which way the rain-bearing storms move, depend on the temperature gradient between the equator and pole in the following manner: If the gradient (or contrast) decreases, the jet streams move toward the poles; if it increases, the jet streams move toward the equator. Therefore, a changing position of the jet stream as a result of a change of the equator-to-pole temperature gradient would result in an alteration of the circulation regime, either turning a dry region into a wet one or vice versa. It may again be noted that it is not so much the impact of the changing temperature itself which has an adverse effect, but rather the changing pattern of water availability, since so much of our life depends on water.

As we saw before, and according to model predictions, in a climate warmed up by trace-gases, surface regions near the poles would warm up much more than regions near the equator, thereby reducing the temperature gradient between equator and pole—which would then result in a poleward shift of the jet streams by a few degrees latitude. Hence, regions at the poleward boundary of the subtropical dry areas would experience less frequent incursions of the polar jet stream with its rain-yielding storm systems. The climate zones would shift—with particularly detrimental effects at the equatorward margins of the westerlies, which would then turn into arid zones.

So far, so good. Turning again to the models, there is one small item someone must have overlooked: It is not the temperature gradient of the surface layers which is important for the position of climatic zones, but the temperature gradient of the *entire* troposphere. And here the models almost unanimously come up with a very surprising result: Even though there is a large warming of the surface layers of high latitudes, and small warming at low latitudes, there is large warming in the upper troposphere at low latitudes and only small warming at high latitudes. As a result, the warming averaged through the entire troposphere is fairly uniform, so that the gradient does not change very much, even though there is warming everywhere.

Consequently, none of the models expects a shift in the position of the major jet streams and of the way the climatic zones are delineated by the circulation regimes. The warming itself does not constitute a shift in a climatic zone the way it is often portrayed by the media. This misconception probably arises from the simple notion that if it gets warmer at any given point, the climate there will be replaced by a climate that is normally observed some distance closer to the equator. But to repeat this point, the climatic zones are defined not only by temperature, but also, and in some cases more importantly so, by precipitation or water availability in general, which is tied not so much to temperature alone but to the position of a geographic area within the general circulation of the atmosphere.

To elucidate this point, think of two places in the U.S. which are roughly at the same latitude and which have approximately the same average annual temperature, namely Los Angeles, California and Savannah, Georgia. As anyone knows, "It never rains in southern California," whereas there are lots of "rainy nights in Georgia." In bare numbers, Los Angeles receives about 15 inches of precipitation and Savannah close to 50 inches, resulting in rather sparse vegetation in southern California and a lush biosphere rich in species abundance in Georgia. The obvious difference in climate, despite similar temperatures, is entirely due to the different position of the two cities within the general circulation.

2) The melting of polar ice caps

Almost nothing in the global warming debate heats up the public like "the melting of the polar ice caps" and the ensuing negative impacts of rising sea levels, inundation of coastal lowlands, and so on.

It sounds so horrific and truly threatening, and it is still one of the biggest misconceptions about the impact of the greenhouse effect. Why? Well, here it goes:

Let us first differentiate between the two polar ice caps on Earth, i.e., the one in the Arctic and the one in the Antarctic.

The Arctic "ice cap" is an ocean which is frozen over and which is surrounded by the land masses of the North American and Eurasian continents. The north polar ice cap is sea ice which is *floating* on the ocean. The GCM model results, in a 2-times-CO_2 scenario, expect this *sea ice* to melt somewhat and to retreat polewards by about 200 miles, but never to melt substantially or even completely.

What would the implications of that melting be then for the sea level? Exactly none. This is simply because, as the *floating* ice melts, it only takes back the sea water volume it displaced when it was floating on the water as ice. You don't believe it?

The situation would be somewhat different, however, in the Southern Hemisphere, because there the ice cap sits on a continent which is surrounded by the oceans. The waters surrounding Antarctica also freeze over and, as in the Northern Hemisphere, the models expect some melting of that sea ice as well, pushing the ice line back toward Antarctica. In terms of sea level rise, we know by now what is (not) going to happen.

Let us assume the wintertime greenhouse warming over an area of Arctic and Antarctic ice is 20°F. During the winter, the actual temperature over most iced-up areas is substantially below 0°F. In other words, even if the temperature rose by as much as 20°F, we would still be very much below the melting point of 32°F.

Furthermore, the large warming expected by most models in high latitudes must not be viewed as the cause of the ice melt but rather as the result of it—for the following reason. As we saw before, all GCMs computer their climate parameters on a net of grid points, which are spaced, depending on the model, 500-1,000 km (300-600 miles) apart. We also saw that a sea-ice melt is expected to extend about 200 miles toward the poles. Over these areas, which would then be ice free—200 miles—temperatures would be in the mid-30s, typical values for the open Arctic ocean, whereas before, over the ice, they were substantially below 0°F. It thus follows that the warming which occurs in the narrow de-iced strip is possible of the order 40°F. This very large warming now is, by the averaging procedures applied in the models, drawn out to the neighboring grid points, spaced 300-600 miles or 5-10° latitude apart, giving the impression that a large area between latitudes 60° and 80° is warming up—not by 40°F but possibly by a still substantial 20°F.

Therefore, because of the internal workings of the GCMs, a warming is predicted which would never exist in reality, even if the general warming projected by the models were to occur. The actual retreat of the sea-ice would result from the more moderate warming of high-latitude oceans, which might be in the neighborhood of 5°F.

We mentioned earlier that the Antarctic is a block of ice sitting on a continent. In fact, more than 90% of all the ice anywhere on Earth is located there. (Greenland accounts for only 5%; the rest is in various glaciers around the world.) Given the alarm over global warming, which is supposed to be particularly large at high latitudes, scientists have tried to estimate what would happen to the Antarctic ice shield in a 2-times-CO_2 scenario. As we have just seen, there would be no significant melting of that shield itself, but only some melting of the sea-ice surrounding Antarctica. If the Antarctic ice shield itself melted completely, which could only happen under much higher temperatures than expected from a CO_2 doubling, and which would take thousands of years because of the slowness of response of that large an ice mass to changed conditions, sea levels would rise by 150 feet, a figure sometimes seen in the media. But clearly, this is not only the concerns of the current debate and may only underscore the fact that, things sometimes appear in the media about the greenhouse effect which have a questionable scientific basis at best.

Back to the Antarctic ice shield. Scientists analyzing its response to a temperature increase which GCMs expect from a CO_2 doubling found out—perhaps to the disgruntlement of many doomsday preachers—that it would *grow* and not melt.

Now why is that? First, as we have seen, since Antarctica is quite cold, even a substantial warming would not result in any significant ice melt. But second, and more important, since the air over and around Antarctica is supposed to warm up so much, it can hold much more water vapor than it can now. The capability of air to hold water vapor roughly doubles with each temperature increase of 20°F. Some of that water vapor would be converted to precipitation and fall out—at the prevailing temperatures in the Antarctic—as snow. That snow would simply stay there and accumulate—eventually thickening the ice pack.

Yet this is in essence a net transfer of water from the oceans to the Antarctic, where it may remain for thousands of years—taken away from the oceans—and actually lowering the sea level by about a foot.

Although this seems completely surprising to many people, climatologists have known it for quite some time. In fact, there is some research which indicates that, over geologic times, there were periods when the sea level was much lower during warm than during colder episodes. This obviously runs counter to the expected sea level rise thought to result from global warming. You might then ask, since the polar ice caps are not going to melt, and in fact may even grow (not in extent but in thickness), why is the sea level expected to rise?

There are two reasons. One, sea water expands as it warms, as all things do. Most of the expected rise in sea level is related to the envisioned warming of the oceans.

Two, because of the expected general warming in the interior of the continents, some melting of the glaciers is thought to occur which would also add to the sea level rise. How much rise from melting of inland glaciers is highly debatable, but definitely less than the rise from ocean warming. But this is minimal with respect to the rise expected due to ocean warming.

3) Rising sea levels and inundation of coastal lowlands

One of the most serious impacts of a global warming must be seen—if correct—in the rising sea level.

In the preceding paragraph we have already seen that outlandish claims of a sea level rise of the order of 150 feet are not supported by modeling results of any possible climate change which might occur from rising trace-gas levels in the next 100-300 years. Such a rise would require a melting of the whole Antarctic ice sheet, which no one expects to happen even from a several-fold increase of CO_2. Even a melting of the so-called West Antarctic ice shield, which rests on a sloping rock plateau below sea level is not expected from any warming of the magnitude envisioned for the next few centuries.

If it melted, sea levels may rise by about 15 feet.

What is expected, then, is a rise of 1-4 feet, mainly as a result of thermal expansion of the ocean waters and some glacial melt in the continental interiors.

But even a rise of only 3 feet would pose almost insurmountable problems to many nations, including the United States. It has been estimated that the damage of this seemingly small rise to a city such as San Francisco alone would be in the billions of dollars.

This picture becomes even gloomier if we consider countries like Bangladesh, which might be flooded to a considerable extent, without having the technological and financial clout to do anything about it.

Recently, scientists seem to have more closely considered the real impact of higher temperatures on polar ice shields, and have consequently lowered their estimates on greenhouse-related sea level rise to about a foot or so for a CO_2 doubling. Indeed, observations indicate that ice shields in Greenland and the Antarctic have been growing in recent years. Less gloom by the day.

4) Increasing frequency and severity of droughts in the American corn belt

The American corn belt is not only the breadbasket of America, but also of a substantial portion of the entire world. If some adverse climate changes were to occur there, the ramifications would not be confined to the farming sector, but would have repercussions on the economy and prosperity of the entire nation as well. For that reason, a thorough exmination of possible future changes appears to be fully justified.

For present purposes, let us define a drought as an extended period of hot weather combined with a lack of precipitation. Since hot weather occurs mostly in the summer half of the year, which is also the growing season, when an adequate supply of water is quintessential and substantial negative impacts on plant growth might result from either a reduction of precipitation or an increase in evaporation, or a combination of both, we can limit the present discussion to the summer months.

A little earlier [see *EIR*, Jan. 10], we examined model-predicted temperature and precipitation for a few selected American cities in summer. We concluded that temperatures increase by about 7°F in cities close to the corn belt (Chicago), while precipitation would not change significantly.

However, an increase in temperature will then in general lead, other things being equal, to additional evaporation and therefore additional drying of the surface soil. Therefore, if the model predictions are correct, we can indeed expect, if not an increasing frequency of droughts, an increasing severity of droughts. The impact of additional drying would be particularly detrimental in those areas which receive marginal precipitation to begin with, namely the Southwest and also the western parts of Oklahoma, Kansas, and Nebraska.

There are two silver linings in this generally gloomy cloud, however, which is, fortunately, still a "what if" scenario. For one thing, because of increasing precipitation in the winter half of the year, which the models expect in their 2-times-CO_2 version of tomorrow's corn belt, there might be some way to store the water and use it during the summer (in an irrigation system such as that proposed by NAWAPA—the North American Water and Power Association) and second, land in more northern regions, which has not been suitable for agricultural use up to now because of cold temperatures, might become suitable in a warmer world.

Furthermore, some of the adverse effects of high temperatures on agriculture could be avoided by planting earlier in the season, which would still be moist and cool enough. The length of the growing season is expected to increase in a warming climate.

The acid test: models vs. reality

Well, now it's finally curtain time! Now we can *finally* find out whether we have been in the land of make-believe or in the land of reality, whether our method was science or science-fiction, whether we should really head for high ground, move north, sell land in the corn belt, or whether it all was a figment of our imagination, a gigantic ooops!, in other words, the *real* rest of the story. Contrary to many public declarations that there would only be losers in a trace-gas induced climate change—although politically quite understandable—it is quite obvious that areas in the mid- and higher latitudes only stand to gain from a climate change as projected by the models; this is particularly true when the beneficial effects of an increased CO_2 level on the biosphere are factored in.

However, there can be no doubt that the possible adverse impacts in other areas of the world warrant serious consideration of remedial and/or preventive measures against such a change—if it will really occur.

The scope of the envisioned changes, but also the scope of the remedial measures are horrendous. It would in fact change the basic frameworks of our societies either if those climate changes really occurred, or if some of the proposed measures had to be adopted. It is absolutely necessary at this point to critically examine those model forecasts before a decision can be made on any course of action to counter a possible threat to the climate.

The usual way to check a forecast is to wait and then compare predictions with observations.

Another way would be to wait for maybe 10 or 20 years, and then see if temperatures have really risen to an extent compatible with model predictions, but still small enough not to have caused any of the expected damage. This is an approach which might not seem the worst of all strategies if one considers, as we will a little later on, that those eras in climate history which were warmer than today by about 2 to 4°F were called "climate optima"—and for good reasons as we shall see. This approach simply assumes that we can afford to wait, because the worst that can happen in coming decades is a slight warming moving us into another climate optimum but giving us more *time* to devise the *best* countervailing measures.

But we can do better than that. We know that trace-gases have already risen for more than 100 years: CO_2 has gone up from about 280 ppm to 350, roughly 25%, other trace-gases, mainly methane and, after World War II, the CFCs have risen much more in percentage terms, so that we now have about 50% of the additional man-made greenhouse effect from all trace-gases combined (or radiative forcing) thought to occur from a doubling of CO_2 alone. It may be noted at this point that the greenhouse effect does not increase linearly with trace-gas concentrations, but at a lesser rate. That means that the emission of a fixed amount of a trace-gas between, say, 1950 and 1980 enhances the greenhouse effect much more than the emission of that same amount between 1980 and 2010, because the earlier emission has—to some extent—saturated the absorptive regions in the spectrum.

The obvious question then is: If the models are right, should it not be possible to see a warming due to the trace-gas buildup which has already occurred?

Simple question, simple answer: Yes! Then let us examine how much global temperatures should have risen if the model predictions were correct.

To do this, models could be run not only in a 2-times-CO_2 mode, but in a 1.25-times-CO_2 mode, or in a slightly higher mode, to account for the additional trace-gases which have built up in our atmosphere—or they could also be run in a mode where trace-gases are continuously added to the atmosphere—thereby simulating real life events. Those models are called "transient response" models.

After carrying out those calculations, the result is that there should have been an "equilibrium warming" of about 2.2°F. We remember that the equilibrium warming is the warming reached after the greenhouse effect has worked its way through all compartments of the—modeled—climate system and after all feedback mechanisms have acted.

As we have seen before, the oceans have a very important function as a sink for atmospheric carbon dioxide and may act as a retardant sufficiently large as to delay a doubling of CO_2 into the 22nd or even 23rd century. But not only do they act as a sink for carbon dioxide—they are also a sink for heat. Some of the heat generated in the atmosphere by the greenhouse effect is transferred into the oceans and stored there. As a matter of fact, the complete and final atmospheric warming will only be achieved after heat transfer equilibrium between oceans and atmosphere has been reached.

The current state of the art of modeling would predict that, due to the oceanic slow-down of atmospheric warming, we should now (in the early 1990s) see a warming of about 1.5°F due to the buildup of all trace-gases. This assumes that the climate would warm by 6.5°F in the case of a CO_2 doubling, approximately two-thirds of the equilibrium warming of 2.2°F. **Figure 2** shows the manner in which trace-gas-related warming should have progressed since the latter half of last century. The warming of 1.5°F will be the yardstick against which to compare the observed temperature trend in the real atmosphere.

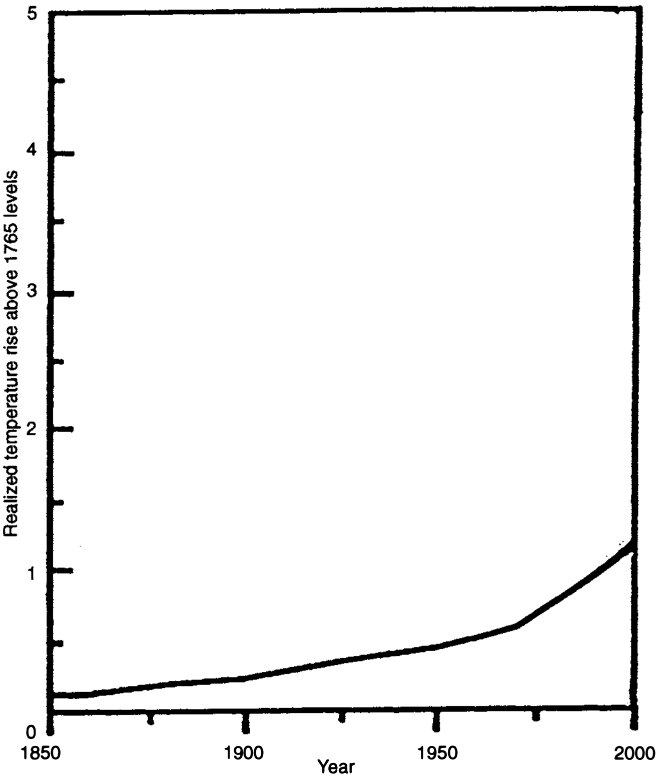
To do this, we will first have to settle the issue of what temperature a modeled rise of 1.5° has to be pegged against. Everyone would agree that it should be the average, long-term state of the atmosphere, unperturbed by the anthropogenic influences we are trying to see.

Going back to the section where we defined climate [see *EIR*, Jan. 10,], we realize that it has to be at least a 30-year period; to eliminate "climatic fluctuations," which are

FIGURE 2

Simulation of global mean temperature rise between 1850 and 1990 thought to have resulted from the observed trace-gas increase

(in °C)



Source: *Global Warming, the Rest of the Story*, after the Intergovernmental Panel on Climate Change, 1990.

characterized by variations in temperature from one 30-year period to another, an average over several 30-year periods would be better yet. This might then characterize an unperturbed, long-term climatic state against which we wish to assess the impact of a trace-gas-related warming.

Since trace-gases are not the only factor which has a bearing on climate, we may face very *long-term* natural climate variations acting on the same timescale as the ones presumed to occur from a trace-gas buildup, and which may act to confuse a trace-gas related temperature trend with one due to natural causes. We postpone that aspect for the time being and only wish to ensure at this point that trace-gas-related temperature changes are not confused with *short-term* temperature fluctuations due to different causes.

A reasonably reliable temperature trend for the Earth as a whole has only been compiled for about the last 140 years. Moreover, we cannot even speak of a truly global trend, because most temperature measurements were only taken over *land*, and therefore, most of the global, Northern Hemisphere and Southern Hemisphere trends talked about in public, and the ones we will be concerned with, are in fact "land-based" temperatures. Let us pause for a moment and consider the implications of that. You may ask: What significance does a land-based temperature trend have if nearly three-quarters of the Earth's surface is covered by oceans? And are we not comparing apples to oranges, when we compare an *observed* land-based temperature trend with a *modeled* temperature trend which includes the oceans? Might it not be that we see a trend over land, which is nullified or at least tempered by a countervailing trend over the oceans?

The greenhouse/global warming debate would not have grown to such proportions had it not been for the fact that the temperature of the climate did indeed increase over the past 100 years, and not only that, six of the warmest years occurred within the last decade, namely 1990, 1988, 1987, 1983, 1989, and 1981 in that order. Some scientists have gone so far as to claim that this is the final proof that the greenhouse effect is indeed with us, and furthermore that the warming we have seen over the last 100 years, which, according to the land-based records, is 1.3°F, is right where it should be according to the models. As a result, they say, we had better be prepared for the full treatment of the model-predicted 6-7°F temperature rise for a doubling of CO_2 and act immediately to stave it off.

Of dips and spikes

Let us start out by considering the land-based temperature trend of the Northern Hemisphere, the Southern Hemisphere and the Earth as a whole for the last 140 years.

Those temperature trends are shown in **Figures 3** and **4.** They have been compiled by a climatic research group in the U.K. Their work is generally perceived to be the most reliable, which is why it is shown and used here.

The temperature curve in this diagram is a so-called filtered curve, designed to suppress the short-term variations we are not interested in. It shows temperature departures from a base period. If we now look at where this line was in 1880, we find it at −0.9°F and if we look again at 1980, we find it at 0.4°. The difference is 1.3°F—Bingo! Just what the models ordered, and there is your "proof."

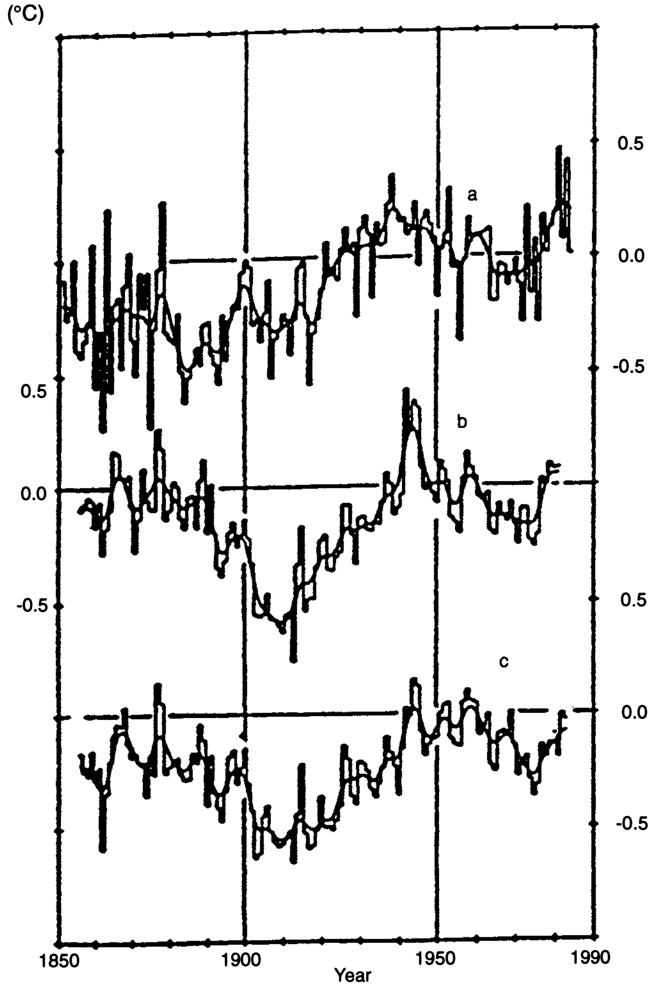
But let us now remember how we have defined climate. For the purpose of detecting a trace-gas-related warming we have to compare the current climatic average to an earlier, unperturbed, long-term climatic average, because without that comparison we run into the danger of relating shorter-term fluctuations, which may occur on time scales of 10 to 30 years, to a presumed trace-gas-related warming.

Hence, we should compare the current, 30-year average to an earlier, unperturbed one.

We now have to determine a span of time in which the climate may be considered to be unperturbed, even if we assume that the modeled temperature increases did in fact take place. For most practical purposes, we may assume that climate remained undisturbed as long as the modeled

FIGURE 3

Observed temperature trends in the Northern Hemisphere since 1850

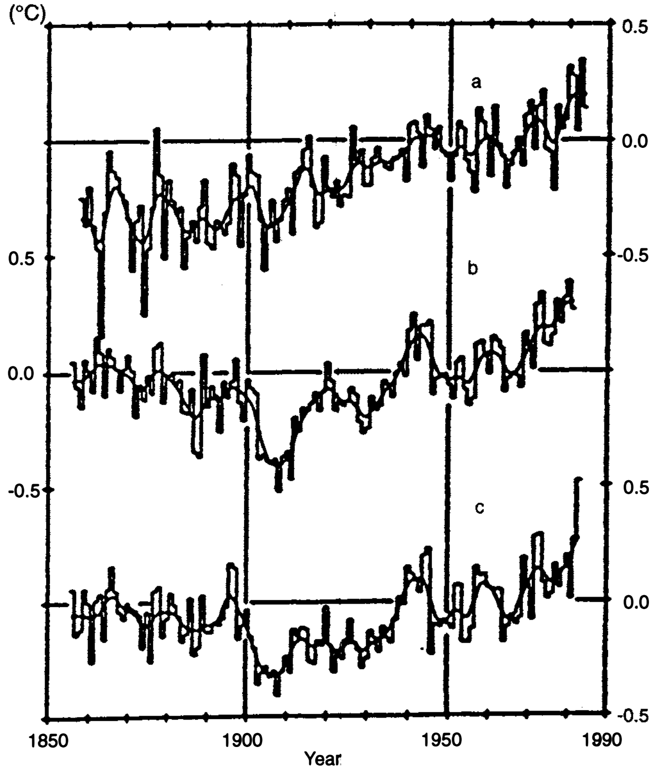


Source: *Global Warming, the Rest of the Story*, Jones et al., *Journ. Clim. Appl. Met.*, 1986a.

The temperatures were observed a) over the continents; b) over the oceans; c) of sea surface temperatures. The smoothed curve shows 10-year averages.

FIGURE 4

Observed temperature trends in the Southern Hemisphere since 1850



Source: *Global Warming, The Rest of the Story*, Jones et al., *Journ. Clim. Appl. Met.*, 1986a.

The temperatures were observed a) over the continents; b) over the oceans; c) of sea surface temperatures. The smoothed curve shows 10-year averages.

temperature increase due to trace-gases remained below about 0.2°F, because 0.2° would be below the limit of detectability and well within the range of natural variability.

We can now look that time up in Figure 3, and we find it to be about 1900. If we now take an average of the temperature between 1850 and 1900, a climatically relevant timescale suitable for our purposes, we find the temperature to be not −0.9° anymore, but −0.5°. If we apply the same kind of averaging procedure to the period between 1960 to 1985, for example, we arrive at 0.2°. If we did the same for the Southern Hemisphere temperature trend, the result would be approximately the same—within the limits of measurability and detectability.

Therefore, if we attempt to estimate the true, i.e., climatically relevant, temperature change over the land masses of both the Northern Hemisphere and the Southern Hemisphere between the latter half of the 19th century and the latter half of this century, we arrive at 0.7°F as opposed to 1.3°. The larger figure of 1.3° is then due to the impermissible gauging from a temporary dip in the temperature curve to a temporary spike.

But those dips and spikes have nothing to do with what is called "climate," let alone climatic change, which is what we are interested in.

You may notice that we have determined the actual, climatically relevant temperature increase over the continents to be only about two-thirds of what it should have been—according to best available model calculations (see Figure 2)—on the average from 1960 to 1985.

Doesn't the ocean count?

However, we are not really concerned with the temperature trend over the land masses alone, since a "global" trend obviously cannot ignore 70% of the Earth's surface, and must encompass the trend over the oceans as well.

Therefore, if we really want to compare observed "global" trends to the model-calculated "global" trends, it is also necessary to consider the temperature trends over the oceans, because all model-predicted temperature changes include the oceans as well. The problem here is that data coverage is much worse than for land areas, and the problem becomes really dramatic the further back in time we go—especially in the Southern Hemisphere.

Scientists have attempted nonetheless to reconstruct a temperature trend over the oceans back to about the middle of last century. Needless to say, extreme caution should be exercised when interpreting the early portion of the data. This is particularly the case in the Southern Hemisphere, where an oceanic temperature trend for the areas between 45° and 65° South latitude cannot essentially be determined for the second half of last century.

Consequently, any temperature trend for the Southern Hemisphere oceans should be viewed with a considerable amount of caution. Temperature trends over the oceans can be determined in two different ways: First, by directly measuring the sea surface temperature (SST) (to which we would have no objection, since according to the models, the SSTs are supposed to warm up by an amount comparable to the warming of the lower atmosphere directly above them), and secondly, by measuring air temperature directly above the water. To reduce unwanted interferences from direct solar radiation and heat trapped onboard the observing platforms, usually ships, of course, which are much worse in the daytime, nighttime temperature records (NTMAT) are used in long-term temperature analyses over the oceans.

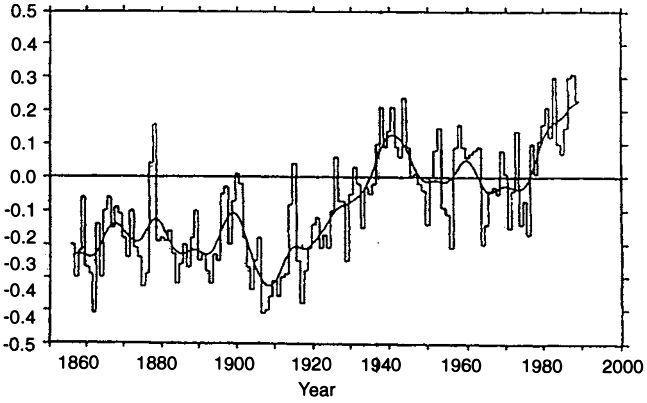
Both sets of records are shown separately for the Northern Hemisphere and the Southern Hemisphere in Figures 3 and 4. You will notice that in both hemispheres, the SSTs and the NTMATs, which are also filtered in the same way the land-based temperatures shown above them are, run very much parallel, as one would expect them to, since, in a long-term average, trends of SSTs and the air temperatures directly above the sea surface should not differ to any great extent.

If we compare the marine temperatures with the land-based ones, we notice a remarkable difference between the two before and around 1900: While there is an almost continuous warming over land between 1880 and 1980, the marine trends show rapid cooling up to the early part of this century, and then warming from then on until about 1960, followed by cooling in the Northern Hemisphere and continued warming in the Southern Hemisphere. In other words, there are some considerable differences between hemispheres and between land and marine trends—particularly in the early portion of the data. There is no reason to doubt the reality of those differences, although we might raise questions about their magnitudes. Let us now progress the same way we did before with land-based temperatures, and define the unperturbed temperature as the average 1850-1900; again, we take the period from 1960-1985 as the recent, trace-gas-tainted period. In the Northern Hemisphere, the average 1850-1900 would be about −0.4° and the 1960-1985 value would be −0.2°, yielding an increase of 0.2°; the corresponding figures for the Southern Hemisphere would be −0.2° last century and 0.2° this century, yielding an increase of 0.4°F.

FIGURE 5

Global temperature trend since 1850 according to IPCC

(averaged over oceans and continents, in °C)



Source: *Global Warming, the Rest of the Story;* after the Intergovernmental Panel on Climate Change, 1990.

Thus, the temperatures over water and the SSTs have increased by about half the amount for temperatures over land. Other research groups have even concluded that there has been no warming at all over the oceans since the middle of last century, and instead a very slight cooling. If their estimates are correct, there has been no global warming at all if oceans and continents are considered together.

But let us stick to the former estimates, which are probably more widely accepted. If we now appropriately weigh those figures according to the fraction of the Earth covered by land and sea in both hemispheres, and calculate a "true global" temperature change which is climatically meaningful, and takes account of the trend over land *and* sea, and which we can therefore compare with the modeled trend, we arrive at a value of about 0.5°F.

This figure is indeed very close to the one arrived at by the Intergovernmental Panel on Climate Change (IPCC). Their global temperature curve is shown in **Figure 5.** It implies—as our figure does—that previous estimates of global warming over the last 100 years or so have to be slashed in half. We now look again at Figure 2 to recall the modeled temperature change for the average 1960 to 1985 and we arrive at 1.3°F. We now realize that the modeled temperature change is larger than the observed one by a factor of nearly three.

This realization may make life harder for greenhouse activists! On the basis of what we have found out so far, we may therefore be justified in seriously questioning not only the correctness of the model projections, but also the demands advanced under the assumption that those projections were correct.