William Gray (le 16 Octobre 2009) : Bilan des prédictions faites en 1996

At NOAA's 21st Climate Workshop in Huntsville, AL in 1996 I presented a paper titled "Forecast of Global Circulation Characteristics in the Next 25-30 Years." We are now 13 years along the way to this paper's verification. All the major features that were predicted are on target.

This 4-page paper's 25-30 year prediction (see below) was based on the known and characteristic multi-decadal changes in the Atlantic Ocean's circulation. It assumed a multi-decadal continuation of the positive change in the Atlantic Ocean Thermohaline Circulation (THC) which occurred in 1995. These changes in the Atlantic Ocean THC were predicted to continue and to result in the following changes in global weather features which have taken place during 1996-2009 in comparison to the similar observed parameter circulation features during the earlier 25-year period of 1970-1994.

1. More Northern Hemisphere blocking patterns - weaker North Atlantic Oscillation (NAO)

2. Fewer El Nino activity (cooler ENSO conditions)

3. Increased Sahel rainfall

4. Much more Atlantic major hurricane activity

5. Small decrease in global mean surface temperature.

These and other predicted conditions are, so far, occurring and beginning to lead to verification of my forecast. This 1996 forecast was made from changing ocean circulation features alone. CO_2 increases played no role in this forecast. Known natural climate features were unquestionably the dominant processes in causing such parameter alterations. If CO_2 gas increases played any role at all its influence was in the noise level and undetectable. Please read the write-up of 13 years ago:

21st NOAA Climate Workshop, Huntsville, AL (1996)

FORECAST OF GLOBAL CIRCULATION CHARACTERISTICS IN THE NEXT 25-30 YEARS

By William M. Gray (written in 1996)

Department of Atmospheric Science, Colorado State University, Ft. Collins, CO 80523

1. BACKGROUND

Over the last quarter century the global circulation has behaved in a number of distinctive ways from its general characteristics in the prior quarter century (mid-1940s to late 1960s). In comparison with the earlier period or with long-term climatology, the period since 1970 has seen:

1. positive southern minus northern hemisphere SST anomaly conditions,

2. stronger middle latitude westerlies over the Pacific and Atlantic and less North Atlantic blocking action,

3. more frequent and stronger El Nino conditions,

4. Sahel drought conditions,

5. less frequent Atlantic major hurricane activity,

6. small increase of surface global temperatures, and

7. many other changes.

These recent quarter century changes appear to be of natural origin. The author hypothesizes that they are a consequence of the abrupt slowdown in the Atlantic thermohaline (or conveyor) circulation which occurred in the late 1960s. This oceanic circulation slowdown was a consequence of the sharp decrease in North Atlantic salinity at this time (The Great Salinity Anomaly). But more recent observations show that Atlantic salinity has been increasing in recent years. It is likely that we are presently seeing a change to a stronger thermohaline circulation. This will likely cause a reversal of the above listed conditions. Back and forth shifts in the strength of the thermohaline circulation on multi-decadal time scales have been documented or inferred from a variety of observational sources going back centuries and thousands of years to the last ice age.

If a return to global circulation conditions more typical of the period 25-50 years ago does occur in the next few years then we should see a general reversal of the above listed global circulation characteristics including a small decrease in average global surface temperature.

Many meteorologists have interpreted the increase in global surface temperature since the late 1960s, and the overall global surface temperature increases since 1900 as an indication that global warming from man induced greenhouse gases. But there are likely other more plausible explanations for such global temperature changes. It is more likely that the surface temperature changes of the last century are a response to naturally occurring temperature changes which are not or very little related to man-induced greenhouse gas increases. Surface temperature changes appear to have resulted from variations in the global ocean conveyor belt circulation.

2. ATLANTIC CONVEYOR BELT CHANGES

It is likely that the multi-decadal alteration in the strength of the Atlantic Ocean's (Fig. 1) conveyor belt circulation is the driving mechanism for much of the global multi-decadal circulation and climate variations which have been observed over the last half century and in past periods. The Atlantic (or thermohaline) portion of the conveyor belt is part of a much larger global ocean conveyor circulation.

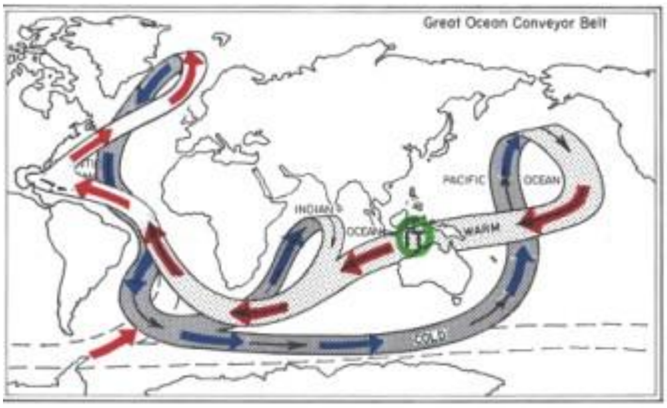

Figure 1: Conceptual illustration of the Atlantic conveyor belt circulation. High salinity water is chilled and sinks in the far North Atlantic, promoting a compensating northward surface layer flow of more warm, high salinity water (after Broecker, 1991).

When the Atlantic portion of the global conveyor belt flows stronger than normal, global circulations and ocean currents take on characteristic patterns which are different from those patterns when the conveyor belt circulation is weaker than normal.

During periods of strong conveyor belt circulation, North Atlantic sea surface temperature (SST) warms but other global SST temperatures tend to cool. Small global surface cooling results because more warm ocean water is taken away from the tropical oceans and advected to the North Atlantic where it sinks (due to its special high salt content). In addition, the eastern Pacific and southern hemisphere oceans, due to slackening of El Nino activity, do not then receive as much warm water from the western Pacific warm pool region. It is known that global surface temperatures tend to increase during El Nino events and be lower during non-El Nino periods.

Strong Atlantic conveyor belt circulation conditions lead to a gradual cooling of global surface temperatures. Such cooling conditions appear to have taken place during the periods of 1870-1899 and 1943-1968 when global surface temperatures were observed to gradually decrease (Fig. 2).

Opposite conditions occur when the Atlantic conveyor belt weakens. A weak conveyor belt leads to a cooling of North Atlantic surface waters. Some of the warmer upper ocean water normally supplied to the North Atlantic when the conveyor belt is strong remains instead over the broader portions of the oceans and affects a general area average temperature rise. It is during these periods of reduced conveyor belt circulation that the western Sahel experiences drought conditions, that Atlantic low latitude hurricane activity is suppressed, and that more frequent and stronger El Nino events occur. These are also the periods when global surface temperatures increase. Such conditions of weak conveyor belt circulation and global surface temperature increase occurred during the years of 1900-1942 and again since 1968.

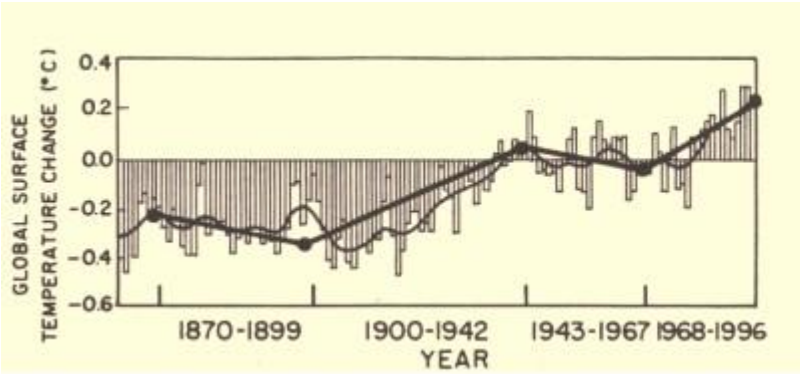

Figure 2: Portrayal of four multi-decadal time periods with different conveyor belt strengths, Sahel rainfall, Atlantic hurricane activity and frequent major El Nino events, and global surface temperature tendency.

Such consistent variations of basic meteorological parameters which are associated with global surface temperature changes suggest a direct cause-effect relationship. It is likely that most of the global warming that has taken place since the late 1960s is due to alterations in the global's ocean circulations which has been driven by a substantial weakening in the strength of the Atlantic conveyor belt. Such basic ocean circulation changes should not be attributed to man-induced greenhouse gas increases.

As the North Atlantic is the primary ocean region where upper water (due to special higher salinity conditions) sinks to deep water levels, it is important to understand the causes of such sinking variation. If North Atlantic Ocean sinking were slowed down (such as apparently has occurred since the late 1960s) then the tropical oceans would advect less energy poleward into the North Atlantic. This normally exported energy to the North Atlantic would go instead into a slow warming of the other ocean regions which feed into it particularly the Indian ocean and the Western Pacific. A gradual and slow warming of the non-North Atlantic Oceans would occur. Such changes have occurred since the early 1970s.

It is observed that there has been a sharp rise in the frequency and intensity of El Nino events since the late 1960s when the Atlantic conveyor belt is believed to have undergone a substantial weakening. It should be noted that El Nino events were less frequent and generally weaker during the 25-year period of 1943-1967 when the Atlantic conveyor belt strength was believed to be much stronger. And El Nino events were also less prevalent during the last three decades of the 19th century (1870-1899) when Western Sahel rainfall and low latitude hurricane activity was enhanced and when global temperatures appear to have cooled somewhat.

Thus, it may be that the general warming of the globe's surface ocean temperatures that has been observed since the late 1960s are but a consequence of the typical multi-decadal alterations of the Atlantic ocean's conveyor belt and of the natural global temperature response to such conveyor belt strength changes.

3. GLOBAL TEMPERATURE CHANGE RESULTING FROM ANTHROPOGENIC GREENHOUSE GAS INCREASES

It is likely that there has not been and will not be a significant warming of the global surface temperatures due to man-generated greenhouse gases over the next 25-50 years. How can this be true when most greenhouse gas models indicate a substantial warming?

Because the evidence for greenhouse gas warming has come from quite complicated numerical models which contain a number of physical assumptions related to moisture and cloud processes which may not well mimic the real atmosphere.

This is particularly the case with respect to the strong warming resulting from the positive water vapor feedback loop which is contained in almost all greenhouse gas modeling simulations.

Water vapor feedback processes represents approximately 75-80 percent of the 2-4oC global warming which modeling simulations show to occur as a result of a doubling of CO_2. Nearly all greenhouse gas model results show that the atmosphere will increases its water vapor content as man-made greenhouse gases increase. It is this extra water vapor increase which is projected to cause the majority of the man-inducedgreenhouse gas warming in the global simulations. The author is of the view that middle and upper-level water vapor which undergo slight decreases (not increases) as anthropogenic greenhouse gases increase.

4. CHANGES IN GLOBAL SURFACE TEMPERATURE TO BE EXPECTED OVER THE COMING DECADES

Since late 1994 an ongoing major rearrangement of the Atlantic Ocean SST features has been underway. These SST changes are broadscale and substantial in comparison with variations taking place during typical two year periods. These include a general warming of the North Atlantic and a cooling of the South Atlantic. We hypothesize that these changes aredue to a major change in the Atlantic Ocean thermohaline or ``conveyor belt" circulation. Salinity contents in the North Atlantic have shown a large increase. These changes are also consistent with other global circulation changes that have occurred during the last 1-2 years. It appears that we are now experiencing a major shift towards a stronger Atlantic Ocean thermohaline circulation. It has been nearly three decades since the SST anomaly patterns of the Atlantic Ocean has experienced such a strong north (warm) to south (cool) SST difference as now observed. We expect that these changing Atlantic SST patterns will lead to enhanced intense (or major) hurricane activity in coming years and to a small global surface temperature cooling. It is likely that the mean global surface temperature change in the next 20-30 years will be more driven by nature than by anthropogenic influences and be one of weak cooling, not warm.