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Climate Prediction: Confusing Present, Uncertain Future

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ABSTRACT

Notwithstanding a general consensus on the increase in global temperature during the 20th century, there are a significant number of scientific studies that do not support a direct cause-and-effect relationship between increase of CO_2 in atmosphere and the observed temperature rise. The studies of Mann *et al.* (1998, 1999), which helped project this relationship and was used by environmental groups and IPCC to clinch the Kyoto Protocol treaty, have been proved unequivocally to be based on flawed data and flawed statistical procedures. While the hard-core data give conflicting signals about the present global warming, computer predictions about the likely future climate of the planet do no better by predicting scenarios that are contradictions in extreme. Together they provide reasons to argue for deficiency in the current understanding about climate. On the other hand, there are several studies that suggest a role for earth's internal dynamics in climate modulation.

Keywords : Climate, prediction, atmosphere, global warming

INTRODUCTION

There is common public belief that increased emanation of green house gases (GHGs), particularly CO_2, from ever increasing anthropogenic activity and their accumulation in the atmosphere is going to lead to 'hot ball earth' with devastating consequences for humanity. Together with comments by experts the regular telecast of vivid pictures of melting ice sheets, sea ice (the oceanic equivalent of clouds in atmosphere) and permafrost in the Arctic region, cracking and floating ice sheets in Antarctica and the receding mountain glaciers in Himalayas, Alps, Rockies and Andes, the bleaching of corals, devastation wreaked by 1997-98 El Niño and European heat wave of 2003, repeated storms in the Atlantic and the Pacific, and recent annual forest fires in Australia, Indonesia, southern Europe and USA have greatly helped to entrench this belief.

That the global temperatures are on the rise has long been discussed among scientific community but what actually gave it a fillip owes to two scientific articles by Mann *et al.* (1998, 1999). Using multiproxy paleotemperature data dominated by tree ring chronologies, they reconstructed global temperature history first of the last six centuries (1400 2000, Mann *et al.* 1998) and then extended it back to past 1000 years (Mann et al. 1999). The plot of the data revealed a pattern famously (or infamously!) called "hockey stick" graph low temperatures varying slightly (representing the shaft of a hockey) until the 1900 AD and then temperatures start to rise suddenly and sharply (representing the blade). The eye catching image of sudden temperature rise in 20th century, along with the negation of Medieval Warm Period (~AD 10001270) so well known from numerous previous studies, was equated with increased industrial activity. The "hockey stick" turned out

to be the center piece to be used by many scientists and environmentalists as well as Inter-governmental Panel for Climate Change (IPCC, 2001) as the unassailable scientific evidence to boost their campaign in favor of reduction in GHGs. The Kyoto Protocol is all about avoiding such a possibility.

However, a large section among the scientific community does not subscribe to the view and allege unsettled science and even politics behind global warming theme. How sound is this allegation and, more importantly, how firmly is it supported by science? Let us see for ourselves.

UNSETTLED SCIENCE

There are several aspects to this ranging from conflicting data, questionable cause-and-effect relationship between CO_2 and temperature to the unresolved role of natural variability to global warming that impinge on conceptual framework for climate prediction. However, we begin with the scientific basis for the "Hockey stick".

***Scrutiny of the* "Hockey stick":** With or without the "Hockey stick", there is general consensus that temperature has been on the rise since 20th century. It is the depiction of more or less stable temperatures from 1000-1900 and unprecedented warming during 1990s that did not sync with a large body of data showing large temperature fluctuations during the studied period. However, "Hockey stick" proved so overwhelming, indeed canonical, that any data in conflict with the graph became suspect and blasphemous.

It is ironic that the demolition of the nce of scientific basis of the "hockey stick" graph first began in Canada, the country that used this graph as an educational and promotional tool against human-induced global warming by distributing copies of the graph among schools across the country (McKitrick, 2005). Reanalysis of the graph by two Canadians, Steve McIntyre (a mineral exploration consultant) and Ross McKitrick (Professor of Economics), have revealed such major statistical and procedural flaws in the construction of the plot as "calculation errors, data used twice, use of wrong data and a computer program that generated a hockey stick out of even random data"; in short, bordering on doctoring the data sets to achieve the hockey stick (Fig.1) (e.g. McIntyre and McKitrick, 2003, 2005a,b; McKitrick, 2005). Later von Storch et al. (2004), von Storch and Zorita (2005), Huybers (2005) (Fig.1) and Crok (2005) and Bürger *et al.* (2005, 2006) also pointed out procedural flaws in the graph and the study as a whole. Indeed, study of these critiques about how the graph was created leads one to doubt the very motive behind the publication of Mann et al. articles in such important scientific magazine as *Nature* and *Geophysical Research Letters* or the acceptance of these results by IPCC, all claiming stringent and high standards of peer review. This feeling gets strengthened when one considers the specious grounds of space limit and "little public interest" that the editorial office of Nature offered to reject publication of a rejoinder on Mann *et al.* (1998) study by McIntyre (McKitrick, 2005). Still more, how this graph was promoted repeatedly in the Third Assessment Report (TAR, 2001) by IPCC over and against better time-series climate data sets, e.g., global average of tropospheric temperatures or world-wide surface temperature data from boreholes (Huang *et. al.* 1997) that do not support Mann *et al.* (1998, 1999) or the

TAR, 2001 conclusions about 1990s being the warmest years of the past millennium is breathtaking. One more study (Esper *et al.* 2005) has added another dimension to the debate by pointing out "substantial divergence in reconstructed (absolute) temperature amplitude" without some identified scientific procedures being followed in data reduction for past temperature reconstruction. Sadly, without paying heed to criticism the self-identified "Hockey Team" scientists continue to publish their work in validation of "hockey stick" climate theory (e.g. Mann and Jones, 2003; Rutherford *et al.* 2005; Osborne and Briffa, 2006) using the same flawed methodology and some of the old controversial data (McIntyre, 2006). Still more sadly, IPCC also has retained some of these scientists for reviewing and assessing the existing published knowledge about global warming and climate change and writing of the 4th Assessment Report.

Hard-core data: Above I mentioned some of the highly publicized hard facts, like the well documented decrease in the Arctic ice cover or receding of Gangotri glacier in the Himalayas over the years, usually marshaled in favor global warming. We now have data from the European Remote Sensing satellites (ERS-1 and ERS-2) that show increase in ice thickness in both interior Greenland (5.4 $\pm$ 0.2 cm/year: Johannessen et al. 2005) and over eastern Antarctic ice sheet interior (1.8 $\pm$ 0.3 cm/year or 45 $\pm$ 7 billion metric tons/ year: Davis *et al.*, 2005) during the studied period1992-2003. The reason given is the increased precipitation due to global warming. The amount of snow accumulating each year in eastern Antarctica alone is calculated to slow sea-level rise by 0.12 $\pm$ 0.02 mm/ year. All along global warming has been the avowed cause of sea-level increase but now hard data suggests it could slow down the rise. Maldives and other low lying countries are not vanishing fast, after all!

Human vs natural contribution: The most basic argument in favor of 'unsettled science' is the geological fact that earth has undergone many phases of warm and cold during its long history. Even during its latest geological era (the Cenozoic, beginning 65.5 Ma) temperature and atmospheric CO_2 content has fluctuated widely. For instance, earth underwent a global warming event due to increased levels of GHGs in the atmosphere at the end of Paleocene (55 Ma ago) that resulted in quick and drastic change in ocean circulation and change in the location of deep water formation from northern hemisphere to southern hemisphere (Nunes and Richard, 2006). Similarly, during the Late Miocene epoch (11.2 5.3 Ma) global temperature was as high as 3° C and 30%, respectively above the present values long way for anthro-activity to catch up with such high warming or CO_2 values in the atmosphere. Then there were glacial conditions in Pleistocene (1.8 0.01 Ma). The interesting aspect of the glacial period is that it was not all through glacial but fluctuated between glacial and warm (inter-glacial) conditions. Each inter-glacial lasted 10,500 years. Irrespective of the still debated question of whether or not we are already out of the last interglacial, the component of natural versus anthropogenic contribution to present global warming remains unresolved.

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The importance of understanding and isolating the role of natural variability to the global warming is also strongly emphasized by recent paleoclimatological studies. Here are some examples: "El Niòo-like climate teleconnections in New England during the Late Pleistocene" (Rittenour *et al.*, 2000); note that the Late Pleistocene was glacial time. "Super ENSO and global climate oscillations at millennial time scales' (Stott *et al.*, 2002) also talks of El Niòo conditions during Late Pleistocene; "El Niòolike pattern in Ice age tropical Pacific sea surface temperature" (Koutavas *et al.*, 2002); and "Permanent El Niòo-like conditions during the Pliocene Warm Period' (Wara *et al.*, 2005).

The question that begs the answer is: If increased GHG in atmosphere are supposed to lead to El Niòo conditions as one is given to understand, then what caused 'Super El Niòo-like' conditions during the Late Pleistocen, remembering the common assumption that reduction in CO_2 is supposed to induce glacial conditions? Also, Pliocene Warm Period (when temperature was 3°C and CO_2 30% higher than present) and the Pleistocene ice age represent two diametrically opposite climatologies. Can the El Niòo conditions in the two opposite climatic conditions be linked to one common cause like orbital forcing, which is the agreed forcing agent for ice ages?

Another important result emerging from one of these paleoclimate proxy studies (Koutavas *et al.*, 2002) is that the eastern tropical Pacific in its coldest part may have cooled by only 1.2° C during the glacial thereby meaning less steeper east-west Pacific thermocline, less strong trade winds and less strong upwelling in the eastern tropical Pacific--- features uncharacteristic of modern La Nièa. So, contrary to the common understanding, the La Nièa is not the right analog for glacial conditions.

Atmospheric CO_2 content and temperature: Irrespective of the common assumption, there are number scientific studies that do not support a direct cause-and-effect relationship between CO_2 content of the atmosphere and the temperature. For instance, data on atmospheric CO_2 and air temperature derived from Antarctic ice cores revealed that during the phases of global warming following the three glacial ages over the last about a quarter million years the temperature increase preceded the rise in CO_2 content of the atmosphere by 400 to 1,000 years (Fischer *et al.*, 1999). The data also revealed that following the end of second ice age CO_2 content remained essentially constant for 15,000 years while temperature continued to drop, and in the it began to drop only after the last ice age was fully established. Cheddadi et. al. (1998), Gagan *et al.*, (1998), Raymo et al. (1998), Pettit *et al.* (1999) Steig (1999), Indermuhle *et al.* (2000) and Monnin *et al.* (2001) reach similar conclusions.

As for details we may refer to the Pearson and Palmer (2000) study. Using planktonic foraminifera shells these authors reconstructed atmospheric CO_2 content and temperature of the past 60 Ma. Their data (summarized in their figure 4) reveals that every time atmospheric CO_2 content changed, temperature changed in reverse direction. For instance, starting with atmospheric CO_2 content at ~3600 ppm and the ^{18}O about 0.3 ‰ at 60 Ma, when the CO_2 content dropped to about 500 ppm at about 48 Ma, the ^{18}O dropped to zero (implying slight increase in temperature). Again, when CO_2 content was 2400 ppm and 1000 ppm at 45.5 Ma and 40 Ma, respectively, the ^{18}O value was close to 0.4 ‰ and 0.6‰, respectively. However, at ~ 43 Ma a dramatic drop in CO_2 content (about 200 - 300 ppm) is oppositely matched by ^{18}O value of 0.2‰. During Neogene Period (25 Ma to the present) while the CO_2 content shows only minor variations, ^{18}O shows large fluctuations marked especially by a sharp increase from about 2.2 2‰ to 3.82‰ (meaning sharp drop in temperature) during the latest 2 Ma when interestingly CO_2 content has been on the rise.

Computer-driven model predictions: The story of the computer driven climate predictions begins when climate was considered to be the interplay between atmosphere and solar insolation; land-sea distribution and orography having secondary role only. Based on this understanding different global General Circulation Models (GCMs) were devised and used for predicting regional and global climate on both short term and long term basis. With growth in understanding about the role of ocean dynamics (primarily about the ocean conveyor belt) in climate modulation, the climate modeling moved forward and climate models began incorporating oceanic parameters as well. Thus, we now have Coupled General Circulation Models (GCMs) that take the interplay of both the atmospheric and oceanic parameters with solar insolation into account for modeling and predicting climate.

Yet, notwithstanding tremendous improvements in our understanding about climate, employment of modern technologies for data collection, and ever-increasing data-computing power, predicting climate is far from satisfactory. I begin at home with monsoon.

"Monsoon prediction Why yet another failure?" This is the title of a recent article by three Indian scientists (Gadgil *et al.*, 2005). The article is based on analysis of monsoon predictions from 1932 onwards by Indian Meteorological Department (IMD), and concludes "that the forecast skill has not improved over the seven decades." This may sound surprising to most of us but should not when viewed in the light of some other predictions by some of the more technologically resourceful climate study groups than IMD. Following two cases, one of short term and another of long term, perhaps tell the story.

First, 2005 was forecast by NASA scientists to be the warmest since 1861 when accurate earth's surface temperature record keeping began. But the forecast turned out far off the mark with the average global temperature rise less (0.3° C above the average temperature from 1951 to 1980) than that for 1998 (the hottest year so far), 2003 and 2004 (0.48° C) and tying with that for 2002.

Second, all computer models predicted a

strong rise in tropical temperatures due to increasing GHGs in the atmosphere. Contrarily, it is the Arctic region that has registered a higher (2.1°F) increase in surface temperatures compared to overall global temperature rise (0.63° F) since 1979 when globe-wide satellite monitoring of temperatures first began.

The prediction about the likely future of our planet is all the more stunning. A review of 17 comprehensive CGCMs by AchutaRao and Sperber (2000), 12 CGCMs by Doherty and Hulme (2002), and then 20 Coupled Model Intercomparison Project CGCMs by Collins *et al.* (2004) leads to:

> Permanent El Niño conditions ('Fire ball earth') vs
>
> Endless La Niña ('Snow ball earth') vs
>
> Will keep swinging as it does today.

We are now told, by none other than one of the best names in climatology, Mark A. Cane, that none of the currently used CGCMs is capable of simulating "real world" climatology without ad hoc fixes (Cane, 2005).

In summary, when both hard data as well as computer predictions present such a contradictory picture, it is not surprising to hear the Chairman, World Climate Conference 2003, Prof. Yuri Izrael, ask: "What is going on this planet warming or cooling? Will ratifying the Kyoto Protocol improve the climate, stabilize it, or make it worse?" These words reflect in absolute exasperation, and not without good reasons.

POLITICS

Several authors have written about politics and business interests playing a role in the propagation of global warming theme (e.g., Crichton, 2004; Demming, 2005). Michael Crichton, the author of 14 books including the *Jurassic Park* and the creator of the television series *ER*, has dealt this subject, though in a fictional mode, in some detailin his latest book *State of Fear* (Crichton, 2004). Even the Chief Editor of such a reputed climate-related scientific journal as the *Journal of Climate*, Dr David Randall has hinted at politics playing a role in the research and publication of climate studies. When asked about the greatest challenges for publishing in the field of climate, Dr. Randall (2002) replied, "A second challenge is to keep the focus on the technical side of the field, without becoming embroiled in the ongoing political nonsense."

Encompassing the two themes, unsettled science and politics, are the conclusion and reaction to the conclusion of a recent classified study '*An Abrupt Climate Change Scenario and Its Implications for United States National Security*' commissioned by Pentagon. The study presents an entirely different possible scenario resulting from increase in atmospheric GHGs by concluding that it would lead to increased melting of ice and sea ice in the Arctic region. The consequent increased supply of cold fresh water to the north Atlantic would stop ocean circulation that, in turn, would cause return of large parts of North America and Europe to glacial conditions within just two decades. No seething dust bowl America and Europe here! Europeans saw political red in the report, accusing the U.S. government of seeking excuse from accepting the Kyoto Protocol.

While phases of unsettled science are usual in the history of development of all sciences, a newer science like climate science being no exception, using science for pushing one's agenda by politicians and interest group may be accepted normal in this age of globalized business interests. But where would one place the following (quotes taken from Jaworowski, 2003-04)?

"Industrial pollution would soon reduce global temperature by 3.5°C." That was predicted in 1971 by Stephan H. Schneider. Based on such categorical scientific inputs, the National Science Foundation issued official statements, like the one in 1971: ". . . [T]he the present time of high temperatures should be drawing to an end . . . leading into the next glacial age"; and then in 1974: "During the last 20 to 30 years, world temperature has fallen, irregularly at first but more sharply over the last decade." Decade and a half later we are sermonized thus: "To capture the public imagination [about global warming] we have to . . . make simplified dramatic statements, and little mention of any doubts one might have. . . . Each of us has to decide the right balance between being effective and honest." Again the words of Stephen H. Schneider (1989), the present guru of global warming. He also is the editor of Climate Change journal, and that provides elaboration to David Randall's reply quoted above.

RETURN TO UNSETTLED SCIENCE

Failure on the prediction front and the conflict in data suggest that some thing fundamental is missed in the current understanding about climate modulation, which in turn spills over to the derivative-forecast models. The situation is best summed up by Cox and Chao (2002). Writing about the possible impact of the increase in earths equatorial radius which began in 1997, they state that the "Traditional GCMs simply do not have sufficient physics or knowledge built into their climatic feedback mechanisms to anticipate sudden changes such as the recently observed J_2 [Earth's oblateness] changes." The increased equatorial radius should impact earth's angular momentum and, in turn, on climate. But such inputs are not possible in the currently employed CGCMs. While including earth's internal dynamics would need a great shift in conceptual framework (more on this in the next section), climate models suffer from many unknowns even within the accepted end-member players. Following two examples one concerning current understanding and the other concerning conceptual frame work highlight this aspect.

First relates to the discovery as late as in 2001 about the overturning in the North Atlantic Ocean speeding up and slowing down by 20 to 30 percent over 12 to 14 year cycles as against the common belief among scientists that such a change occurs over hundreds of years (Häkkenin, 2001). Firm prediction demands firm inputs.

Second is the modeling study by Adkins *et al.*, (2005), which builds upon previous studies on (a) deep sea pore fluids indicating that the Pleistocene deep glacial oceans were gravity (salinity) stratified, compared to thermal stratification of the modern oceans (Adkins *et al.*, 2002); and (b) benthic foram ä^{18}O data (Duplessy *et al.*, 1988, 2000; Shackleton *et al.*, 2000) suggesting that the deep glacial Pacific Ocean was

warmer by ~2°C than the deep North Atlantic. With its high potential energy, the bottom glacial salty waters are suggested to store background heat (from earth's heat flow) producing an instable condition wherein cold fresh waters overlie warm salty waters. The authors (Adkins *et al.*, 2005) write: "This salt-based storage of heat at depth is analogous to Convectively Available Potential Energy (CAPE) in the atmosphere. The "thermobaric effect" in the seawater equation of state can cause this potential energy to be released catastrophically. Because deep ocean stratification was dominated by salinity at the Last Glacial Maximum (LGM), the glacial climate is more sensitive to charging this "thermobaric capacitor" and [its sudden discharge] can plausibly explain many aspects of the record of rapid climate change. Our mechanism could account for the grouping of Dansgaard/Oeschger events into Bond Cycles and for the different patterns of warming observed in ice cores from separate hemispheres."

Though not without some major kinks (Toggweiler, 2005), the proposed mechanism no doubt introduces an entirely new perspective to climate forcing.

Background geothermal heat flow is not the only heat source that could affect bottom water temperature. There also is ocean ridge and off-ocean ridge magmatism with associated heat and many GHGs. Also, warming of deep waters will have consequences for CO_2 budget of oceans (as warm water holds less dissolved CO_2) and atmosphere.

EARTH'S INTERNAL DYNAMICS IN CLIMATE MODULATION

The mainstream climatologists would rubbish the very thought. But the possibility was raised by Daniel Walker first in 1988 and then again in 1995 and 1999 by pointing to increased tectonic activity (like T-phase seismicity, magmatic upwelling and hydrothermal venting) along portion of the East Pacific Rise (EPR) preceding by up to six months each El Niño event studied since 1964 (Walker,1988, 1995, 1999) (Fig. 2). The association of the two phenomena is so significant that Walker called the increased seismicity along the EPR as the "Predictors of El Niño" (Walker, 1999).

Leybourne and Chris Smooth took the idea forward by drawing attention to the discovery that each high pressure (HP) and low pressure (LP) cell of the three global oscillation systems (GOS, Fig. 3a) that control world weather are underlain by typical geological structures with vortex geometry and with typical geophysical characteristics (Leybourne and Smoot 2000 and references therein). It is the sea-saw of sea level pressure between HP and LP cells that determines large scale regional weather patterns within the area of each of these GOS. Thus, the best studied Southern Oscillation with which is El Niño associated (therefore called El Niño Southern Oscillation or ENSO) and controls weather systems over equatorial belt and large parts of the southern hemisphere has its HP cell hovering over Easter and Juan Fenandez Islands and LP cell over Banda Sea (Fig. 3b). Easter and Juan Fernandez islands both sit on the East Pacific Rise. The structural geometry, deduced from side-sonar images and high-pass GEOSAT altimetry data, show the Easter Island like an elliptical ring on the

ocean bottom (Fig. 4a). Their description for Juna Fernandez include: "Enclosing the core of microplate, the inner pseudofaults form a pattern resembling the meteorological symbol for a hurricane" (Larson *et al.*, 1992), and "The result is a feature that appears much like a geological "hurricane" embedded in the crust of the earth' (Bird, 1994). 'Hurricane' both the Easter and Juna Fernandez Islands are, for they are anti-clockwise rotating and magma downwelling vortices, as against magma upwelling in the case of Banda vortex (Fig.4b).

The other two GOS, the North Pacific Oscillation (NPO) controlling North American weather patterns, and the North Atlantic Oscillation (NAO) controlling European and Siberian weather patterns (Fig. 3a), repeat the pattern. The NPO has its high pressure cell over the Lake Baikal the deepest lake along a continental rift zone -- and the island arcs and trench systems in northwestern Pacific Ocean and low pressure cell over the Mid-Pacific Mountains and Hawaiian volcanic islands (Fig. 3b). Finally, the high pressure cell of the NAO is an OSC along the Mid-Atlantic Ridge near Azores while one of the globally major upwelling vortices -- the Iceland lies under its low pressure (Fig. 3b).

Another interesting observation relates to the similarity between the global wind pattern and the orientation of ocean ridges in the two hemispheres: vacillation of wind system generally between meridional (over North America and Europe) and zonal (over eastern Asia) flow vs meridional ocean ridges on the west of north America and in the Atlantic, and then absence of any ocean ridge in Asia in the northern hemisphere. In the southern hemisphere both the wind system and ridge pattern are largely zonal.

Relating these geological observations with what is already known could provide clues for understanding the tectonic link to climate. For instance.

(1) there is long known conclusive evidence of a direct relationship between barometric pressure change and the force of gravity (Warburton and Goodkind, 1977) with values of 0.30 *u*gals/*m*bar with typical fluctuations in the 6-45 *u*gal range. Which drives which: Atmospheric pressure shifts causing microgravity fluctuations or the vice versa?

(2) The detection in 1996 (just before the onset on 1997-98 El Nino) of a microgravity wave moving eastward through Europe in the vicinity of Membach (Belgium); this gravity wave, detected over a period of 6-month interval, showed an increase of approximately 17 μglas, which the authors inferred to be "mainly of geophysical origin" (Francis et al., 1997).

(3) Above I mentioned about the detection of the increase in Earth's dynamic oblateness (J_2) since 1997-98 coinciding with the !997-98 El Niño event. After ruling out various possible causes, like rising global sea levels, faster glacial ice melting and changes in ocean circulation, the authors, Christopher M Cox and Benjamin M. Chao (2002) conclude: "One possible cause could be net material flow driven by the geodynamo in the fluid outer core and along the core-mantle boundary." A closer look at their data (fig. 2 of Cox and Chao, 2002) shows that similar changes in J_2, though muted compared to the latest one, were temporally associated with El Niño events since 1980's, particularly those of 1982-83 and 1991-94 events (Cazenave and Nerem, 2002); and

(4) Reversal of ocean circulation pattern in the

Adriatic Sea reversed for about two weeks from counterclockwise to clockwise during the European heat wave in summer 2003. Preceded by clustered earthquakes on 1 April 2003 in the Adriatic, the reversal of circulation pattern coincided with an anomalous burst of geothermal flow raising the sea surface temperatures in the Adriatic basin by 6° C (G. Gregori, personal commun. 2004). Two more clustered earthquake events occurred during this period just before the heave wave hit the Europe, one in the Aegean Sea and second in the north Algerian-Mediterranean Sea. These observations, very similar to the EPR seismicity preceding El Niòo, further strengthen the argument in favor of possible tectonic modulation of climate.

In summary, there appears a definite pattern between atmospheric phenomena and geology. The two important physical parameters that get affected due to tectonic activity in the listed geological phenomena are pressure and temperature and these are the parameters that control wind movement and weather patterns. This certainly needs attention.

CONCLUSIONS

McIntyre and McKitrick have conclusively proved that it is the proper scientific scrutiny, not the biased or lay public opinion or even majority vote, which can decide on the validity of a scientific study. Mann *et al.* may have pioneered an approach but the scientific basis of their "Hockey stick" is as shaky as was found for Dr Huang's stem cell study that recently rocked the medical science. While scientific basis for GHGs, especially CO2, leading to rise in global temperature remains to be established, computer predictions about the future climate are quite uncertain, ranging as they are from 'Permanent El Niño conditions' to 'Endless La Niña' to 'Will keep swinging as it does today.' New satellite data has further added to the confusion. The data collected by the European Remote Sensing satellites (ERS-1 and ERS-2) over a period of 11 years (1992-03) show increased snow accumulation in both the interior Greenland and eastern Antarctica. The authors of the study attribute increase in snow accumulation to the increased precipitation due to global warming and conclude contrary to what is oft-repeated -- that this should slow sea level rise.

The conflicting picture from data and computer predictions more likely reflect that something fundamental is missed in the current understanding about climate modulation. That earth's internal dynamics is likely a part of the missed aspect is emphasized by the discovery of increase in T-phase seismicity and other tectonic activity along portions of the East Pacific Rise preceding each El Nino event, phases of sudden change in J_2 coinciding with El Nino events, and the discovery of typical geological structures underlying each of the high pressure and low pressure cells of the three global oscillation systems. Climatologists have already embraced geological records for clues about past temperature data in order to extend the very limited instrumental data base. The need now is to lower their camp guards a little further and let in ideas and understanding about the tectonophysics for possible clues to climate modulation and interfacing with the existing conceptual frame work.

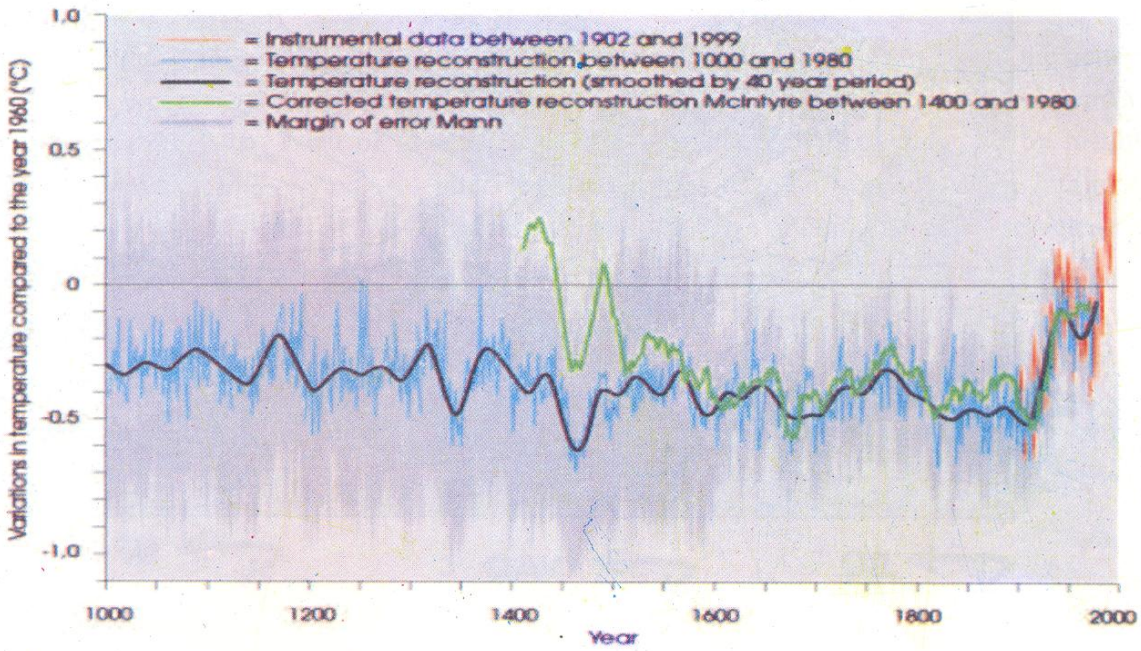


Fig. 1 The black line is the "hockey stick" curve of Mann *et al.* (1998,1999) depicting temperatures history of the past 14 centuries. Green line is the "corrected" curve derived by McIntyre and McKritrick (2003) from the same data set used by Mann *et al.* (1998).

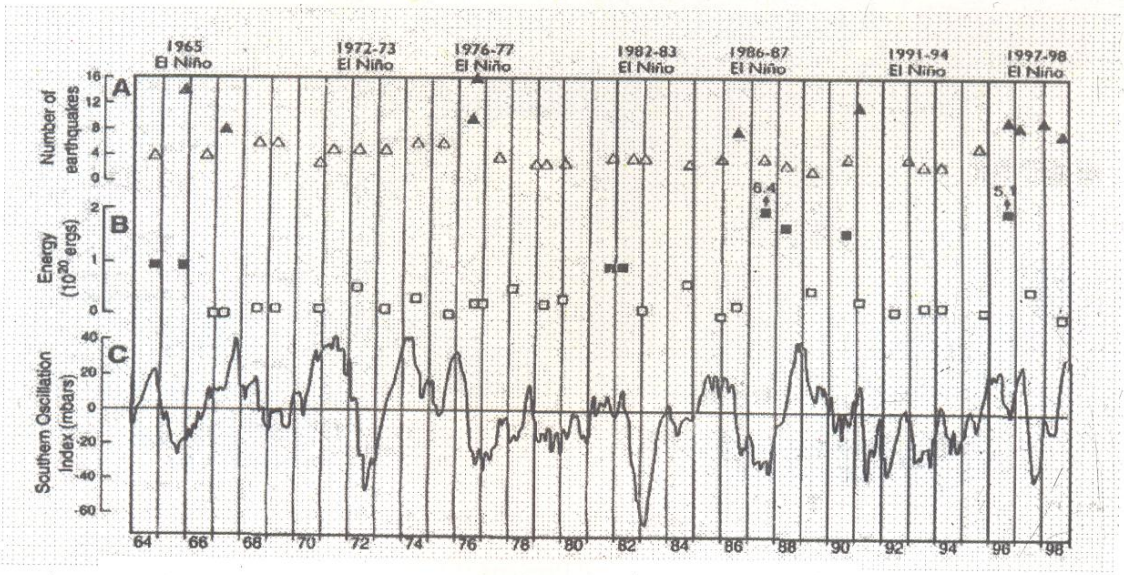
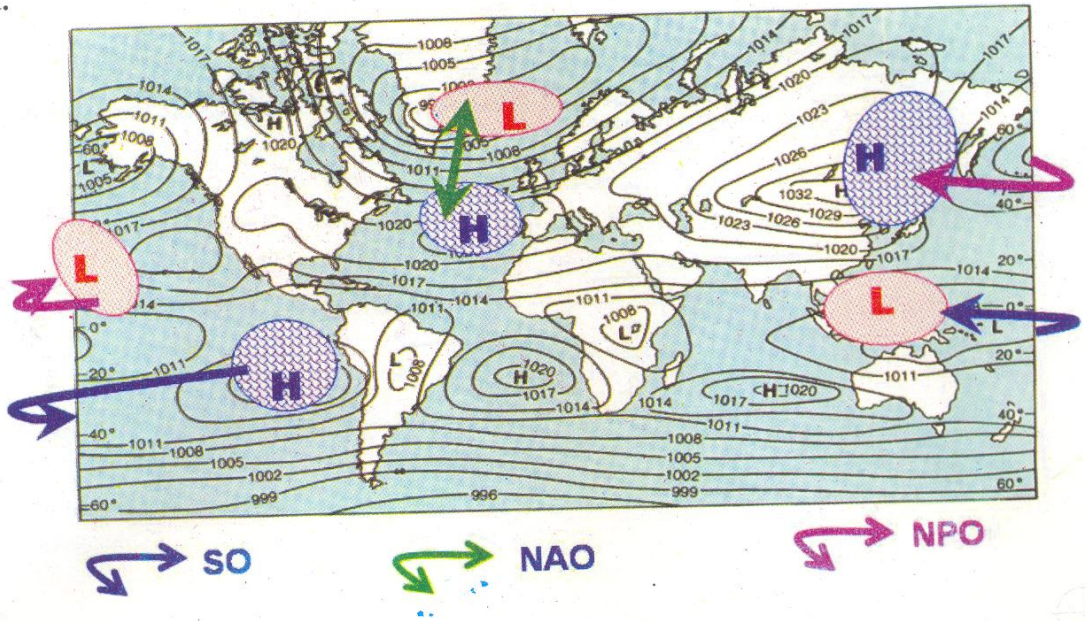


Fig. 2 E1 Nino seismicity correlation (from Walker, 1999)

☞ Months having the greatest number of earthquakes in any given year; ? all values 8M or more
☞ Months having the greatest amount of seismic energy in any given year;
all value of 0.0 x 1020 ergs or more

a.



b.

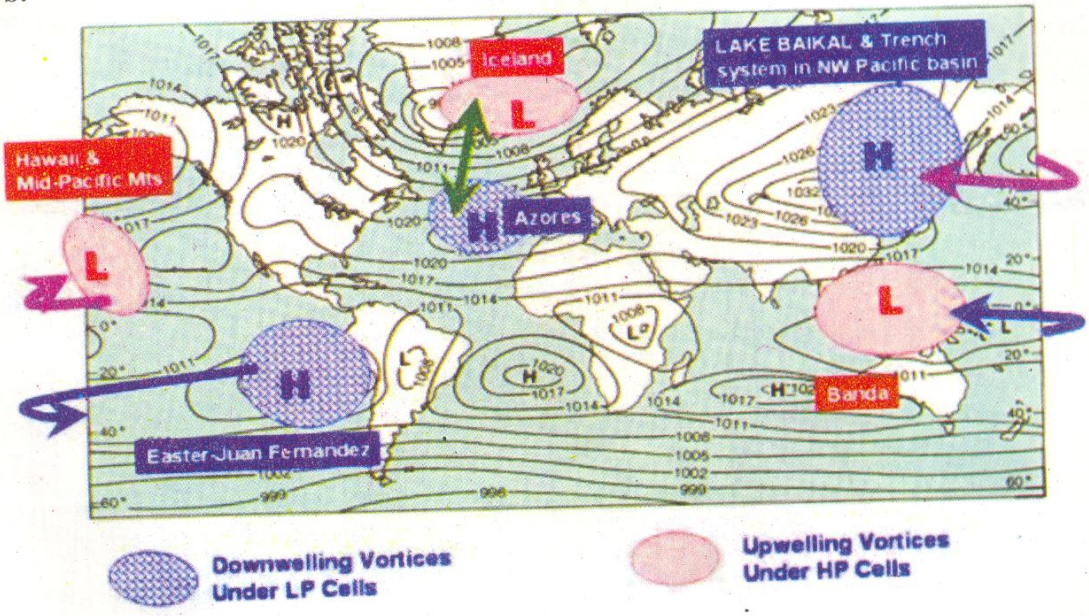


Figure 3. (a) Three major global Sea Level Pressure Oscillation Systems controlled by a seesaw of three sea level HP - LP pressure cells. SO, Southern Oscillation; NAO, North Atlantic

Oscillation; NPO, North pacific Oscillation. Background map showing isobars and the general wind pattern in the northern and southern hemisphere from 'Meteorology' by J. M. Moran and M. D. Morgan (1991). (b) Each of the HP/LP cells of the three GOS is underlain by magma upwelling/downwelling vortex. An interesting feature of tectonic vortices is the intriguing similarity of their diameters (300--1200 km) with a broad range of dominant geoid wavelengths (at 280, 400, 660, 850, 1050 and 1400 km) deduced from the altimetry data for the Pacific Ocean and to several seismic discontinuities (at 410, 660 and 1050 km) within the mantle (Weissel et al., 1994). The Easter and Juan Fernandez vortices are 300-400 km in diameter, and the Banda vortex, the largest on the surface of the Earth, is 1100-1200 km.

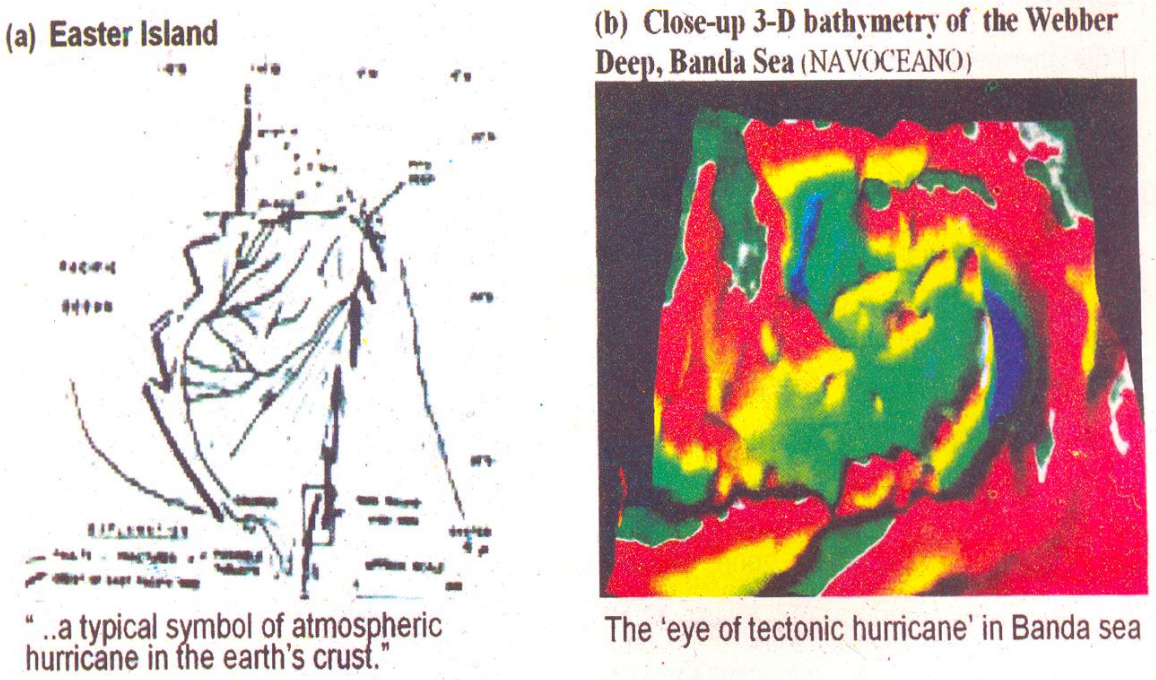


Fig. 4. (a) Simplified tectonic disposition of Easter Island based on Gloria and SeaMARC II sonographs (from Meyerhoff et al. 1996). (b) 3-D bathymetric view of Webber Deep in the Banda Sea (NAVOCEANO).

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