P5.14 Understanding Global Warming: Tracking the Salt Oscillator

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1. INTRODUCTION

The worldwide ocean Conveyor (Figure 1) has frequently been identified as the reason for the end of ice ages. Several publications have postulated the Conveyor as a driver for Sahel rain fall, SOI/ENSO, El Nino's, North Atlantic sea surface temperatures, Azores High Pressure, Atlantic Trade Wind, Atlantic major hurricane activity, and global surface temperature changes (Gray, 1997).

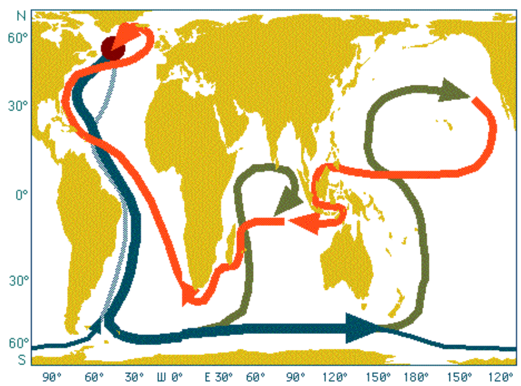

Figure 1: The Worldwide Ocean Conveyor. Darker shades represent undersea pathways (Courtesy of M. Tomczak)

Previous authors have postulated that the highly saline Mediterranean outflow is a driver for the Conveyor (Reid 1979; Price 1993). Gray (1997) posits that a stronger "salt oscillator" that drives the Conveyor is "somewhere in the Indian Ocean". Herein evidence is presented that the Red Sea, with a salt-concentration factor four times higher than the Mediterranean, could be a likely source for the salt-oscillator (see Table 1, end of paper).

2. CONNECTION TO THE RED SEA

El-Nino-severity-and-interval plots (Figures 2 & 3) indicate that the two most severe climate periods in the last 2,000 years were immediately preceded by openings of the Suez Canal (in 1869 and 700 AD). In addition, Wilson (2001) shows each major global warming for the last 7,000 years has been preceded by a canal linking the

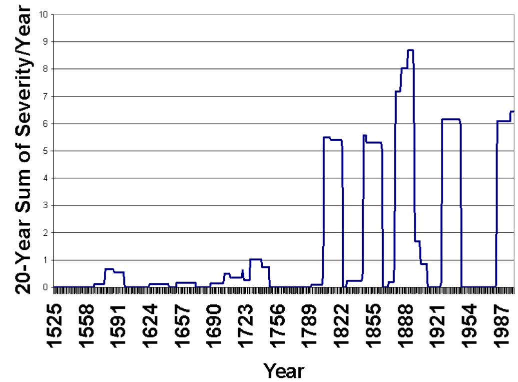

Figure 2: Measure of frequency & severity with 20-year moving window (highest peak occurs just after opening of Suez Canal in 1867). Data from Quinn (1987)

European Mediterranean with the Red Sea (the Pharoahs of Egypt dug such canals several times).

The relationship between El Nino's and monsoons (Khandekar, 1984) provides a record of El Nino's going back to 600 AD (Quinn, 1992). The frequency and severity of El Nino's for the 1300 years of that record are shown in Figure 3 with a heavy clustering beginning about 700 AD. This heavy clustering apparently resulted from the Suez Canal that the Arab conquerors of Egypt dug around 700 AD. Note that enough salt was flushed to cause a 2nd clustering beginning around 800 AD, even though the Arabs closed the canal around 775 AD for security reasons. (The parameter plotted in Figures 2 & 3 is severity divided by time-since-last-El-Nino, summed within a 20-year moving window).

3. NATURAL SEQUESTRATION OF SALT

For most of recorded history, the Red Sea has been a large bay that concentrated the world's salt water by strong, dry desert winds and geothermal brine pits deep under the Red Sea. As more and more "normal" seawater entered this bay from the Indian Ocean, to be cooked down to highly saline water, the less-salty Conveyor gradually slowed down, cooling the earth.

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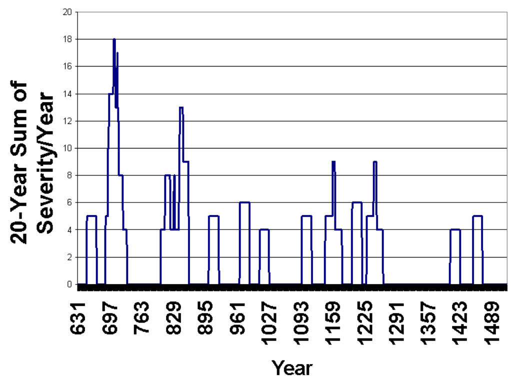

Figure 3: Frequency/severity plot for earlier data (highest peak occurs just after opening of Arab Canal around 700 A.D.)

Periodically throughout history, man has connected the Mediterranean and the Red Sea waters. When that happens, the Red Sea “bay” becomes a river, distributing to the Conveyor the salt sequestered for centuries.

4. AN EXAMPLE OF CLIMATE PREDICTION

The ProCon computer code, which **Pro**jects **Con**veyor behavior, was tuned with Port Said sea-level data (representing salt flow through the Red Sea). Figure 4 shows this projection. This time series ended in 1946.

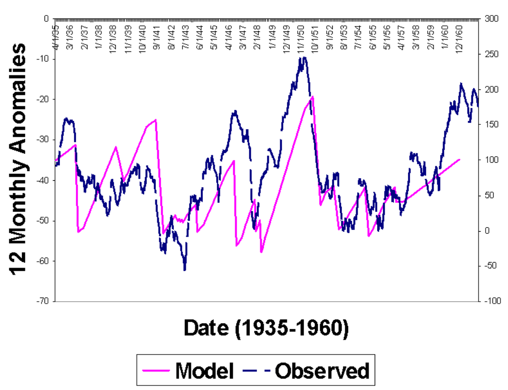

Figure 4: Temperature in England 10 years into the future, Test-Model (parameters based upon goodness of fit)

Then, ProCon was proofed (i.e., no parameter changes) with a newer sea-level time series on the east coast of the Black Sea, at Tuapse (data from ftp://bisag.nbi.ac.uk/pub/psmsl/psmsl.dat The results are shown in Figure 5).

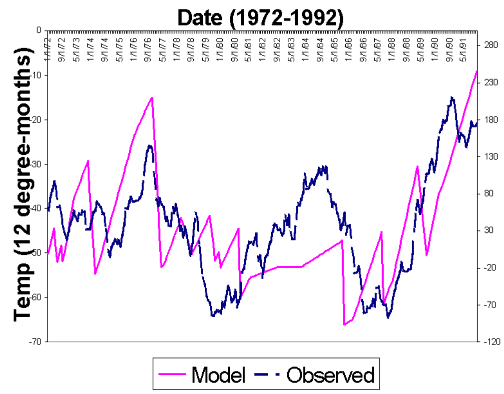

Figure 5: Temperature in England 10 years into the future, Proof-Model (i.e., no change to code parameters)

5. EASTERN PACIFIC TRADE WINDS

In climate models that only look at the Pacific Ocean basin, eastern Pacific trade winds are identified as a precursor to El Nino's. ProCon predicts these trade winds 10 years ahead of time (see Figure 6). This would imply an oceanic, Conveyor-based driver for El Nino's, rather than atmospheric. No doubt there are many other drivers and effects not discovered yet.

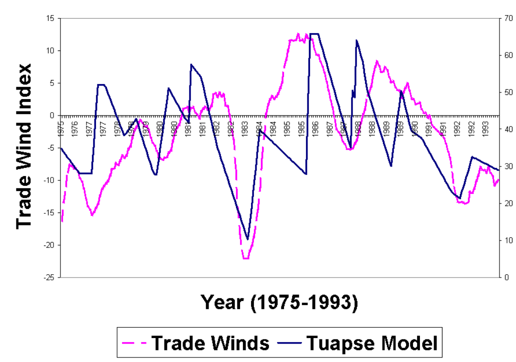

Figure 6: ProCon prediction of East Pacific trade winds based on data over 10 years old

6. CLIMATE - PREDICTION WEB SITE

My climate - prediction web site (www.srv.net/~wilson/PCClimate) contains raw, smoothed, and residual data, for successful as well as not-yet-successful time series. As I update ProCon, I will post the latest time series (check the date at the top of this site regularly).

7. CONCLUSIONS AND RECOMMENDATIONS

This paper points out that climate prediction:

1. Appears to be strongly affected by highly saline Red Sea flows into the Indian Ocean branch of the Conveyor
2. Has many other drivers yet to be discovered
3. Is very complicated, and must not be left to just a few super-computer experts; all the brainpower that can be mustered will be profitably used. A good way to accomplish this is a web site posting the latest data, so many researchers can participate.

8. REFERENCES

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Table 1: Comparing Red Sea and Mediterranean Sea Outflows and Salinities

Parameter	Red Sea	Mediterranean Sea
Outflow (Sverdups, where 1 Sv = 1E12 g/sec)	0.7 (a)	0.76 (b)
Salinity [parts/thousand (ppt) or practical salinity units (psu)]	40.5 (a)	~38 (b)
Local Conveyor Salinity (ppt or psu)	36.5 (c)	37 (d)
Outflow/Conveyor Delta (ppt or psu)	4	~1
References: a — Murray 1997; b — Bryden 1988; c — Stuiver 1980; d — Encyclopedia Americana 1990		