# "Geophysical Processes, Climate Cycles, and Nutrition."

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## ABSTRACT

Methods of testing hypotheses on the relationships between geophysical processes, climate cycles, and nutrition are reviewed. A modification the climate-modelling pyramid (Shine & Henderson-Sellers, 1983) is proposed to give a more complete perspective of climate modelling by adding a fourth edge, BIOSPHERIC PROCESSES. The magnitude of this job crossing over at least 25 fields of science requires a bookkeeping system that can be based on a simple taxonomy. A draft of a handbook using such a taxonomy will be displayed in which components of a hypothesis are classified as to which stage they are in: philosophical, engineering, or scientific. Other stages needed for public policy making are also described. This is done to facilitate communication between generalists and specialists working on the climate change problem.

## INTRODUCTION

My objective here is to organize an approach to the climate change problem that optimally utilizes my own knowledge and experience for the benefit of the biosphere and humankind. This also requires the learning of techniques on how to coevolve with the biosphere. I aim to use my early birdseye view of many fields of science acquired in college while studying electrical engineering (1936-1940). I aim to rekindle the "zeitgeist" (1) of the group of scientists and engineers with whom I worked at the M.I.T. Radiation Laboratory (1941-1945) .

## AMERICAN SOCIETY FOR CYBERNETICS

Some of the concepts presented at the American Society for Cybernetics meeting in Washington, DC, in October 1981 are particularly illuminating. 1) Two models of the same situation give an added dimension. This concept needs to be applied carefully to climate models to insure that we have at least two quite different computer simulation models for all major problems. 2) In the field of amplification of intelligence and regulation, we have reached a stage where it is possible for four computer simulation project managers to control the direction of four billion people on our planet through a simulation program on super computers that influences government decision makers. (2) This type of social regulation by an elite group can be investigated and blocked by Raskin and Bernstein's "new ways of knowing" techniques of applying anthropological methods to the review of current scientific research. (3)

## TRANSITION FROM COMPUTER-COMMUNICATIONS TO GENERAL SYSTEMS TO CLIMATE STUDIES

During my twenty-seven years working for IBM Corp. most of my work was on computer-communications systems. I had some contact with the climate and glacial cycle problems back in 1957 when I was analyzing the prospective need for computers and communication systems in geophysical research, and again in 1964 when the IBM Dept. I was in did some weather simulation studies.

In 1954 I participated in the organizational meetings of SGSR at Stanford and Berkeley. Since 1969 I have been using John Platt's (4) method of plotting world problems on a matrix of "problem intensity" vs. "time to go critical" to see which problems I should work on evenings and weekends. The problem of melting polar ice caps moved up from the bottom of the table to near the top and became transformed into the problem of the complete glacial cycle.

## COEVOLUTION WITH THE BIOSPHERE

Since 1982 we have had a working hypothesis, in the form of the Hamaker Thesis (5) on which to base a plan of action based on decision under uncertainty plus the background of the 1940's MIT Radiation Laboratory procedures to assist us in laying out a strategy. Research at the Academy of Sciences of the U.S.S.R. and at IIASA in Austria (6) has produced many valuable concepts on the problem of relating Biospheric processes to the climate change. A draft handbook (7) has been prepared in which the parts of the problem are separated into the following sub-sections:

Philosophy, economics, education, and ethics;
Scientific research;
Decision & Strategy;
Engineering;
Production of Materials, Tools, and Systems;
Emergency action.

## TESTING OF HYPOTHESES

Consider the block diagram of the climate system in the Systems Research paper by F.B. Wood, Jr., "The Need for systems research on global climate change." (8) This system has 57 sub-blocks, and includes sections with short time constants and sections with long time constants. To develop a computer simulation of the climate system following this block diagram is a goal not easily achievable with even our fastest computers. Until we achieve such a goal, the best we can do is to 1) make different computer simulation models that emphasize different parts of the problem, and 2) make up tables with rows of experiments versus columns of theories of climate change as in my paper in the 1987 ISGSR Conference Proceedings (Budapest). (9)

## SUMMARY OF TABLE OF HYPOTHESES (Ref. 9)

Five theories of climate change (columns) are tabulated against forty-six rows of experiments and data. Two columns

have no disagreements, namely the SOIL NUTRITION GLACIATION CYCLE THESIS (Hamaker Thesis) and the 2500-YEAR LITTLE ICE AGE THEORY. The first of these has 29 agreements (A's) and the second has 22 A's. The SIMPLE GREENHOUSE WARMING THEORY has 7 A's and 3 D's.

Both the SOIL NUTRITION GLACIATION CYCLE THESIS and the SIMPLE GREENHOUSE WARMING THEORY have in common the following action implications:

We must reduce the release of CO/2 into the atmosphere by reducing the burning of fossil fuels, reforesting the earth, and stopping the deforestation of tropical rainforests.

In addition the SOIL NUTRITION GLACIATION CYCLE THESIS points to the need for replenishing the natural distribution of minerals and trace minerals in the soil and protection of the natural microorganisms in the soil needed for transferring the minerals from the soil to tree roots.

These procedures show promise of changing the earth's glacial cycle so that we can sustain over five billion people on the planet. (10,11) More details on soil remineralization is available in the newsletter: Soil Remineralization. (12)

## INTEGRATION OF OTHER SIMULATION SYSTEMS WITH GENERAL CIRCULATION MODELS

Henderson-Sellers and McGuffie (13) list the major components of a model of the climate system as follows: Radiation; Dynamics; Surface processes; and Resolution in both time and space. I add a fifth component: Biospheric processes including tectonic processes; nutritional minerals in the soil; microorganisms in the soil; vegetation, esp. trees; animals; and humankind. There are four basic types of model: 1) EBM; 2) RC; 3) SD; and 4) GCM. Henderson-Sellers uses a climate-modelling pyramid to illustrate how the first three have become integrated into the fourth, or GCM models. This pyramid is shown in Fig. 1.

I recommend that the climate-modelling pyramid be modified to include a fourth edge, "BIOSPHERIC PROCESSES including tectonic processes, nutrient minerals in the soil, microorganisms in the soil, vegetation, especially trees, animals, and humankind. In Fig. 1, I have added the Hamaker thesis as a one-dimensional conceptual model on the pyramid, below the base line, because so far no one has published a precise mathematical simulation of it. Hamaker uses a careful study of all the known factors with comparison with past glacial cycles with graphical analyses.. The cloud feedback simulation from Hamburg (14) is also added to the biospheric processes edge.

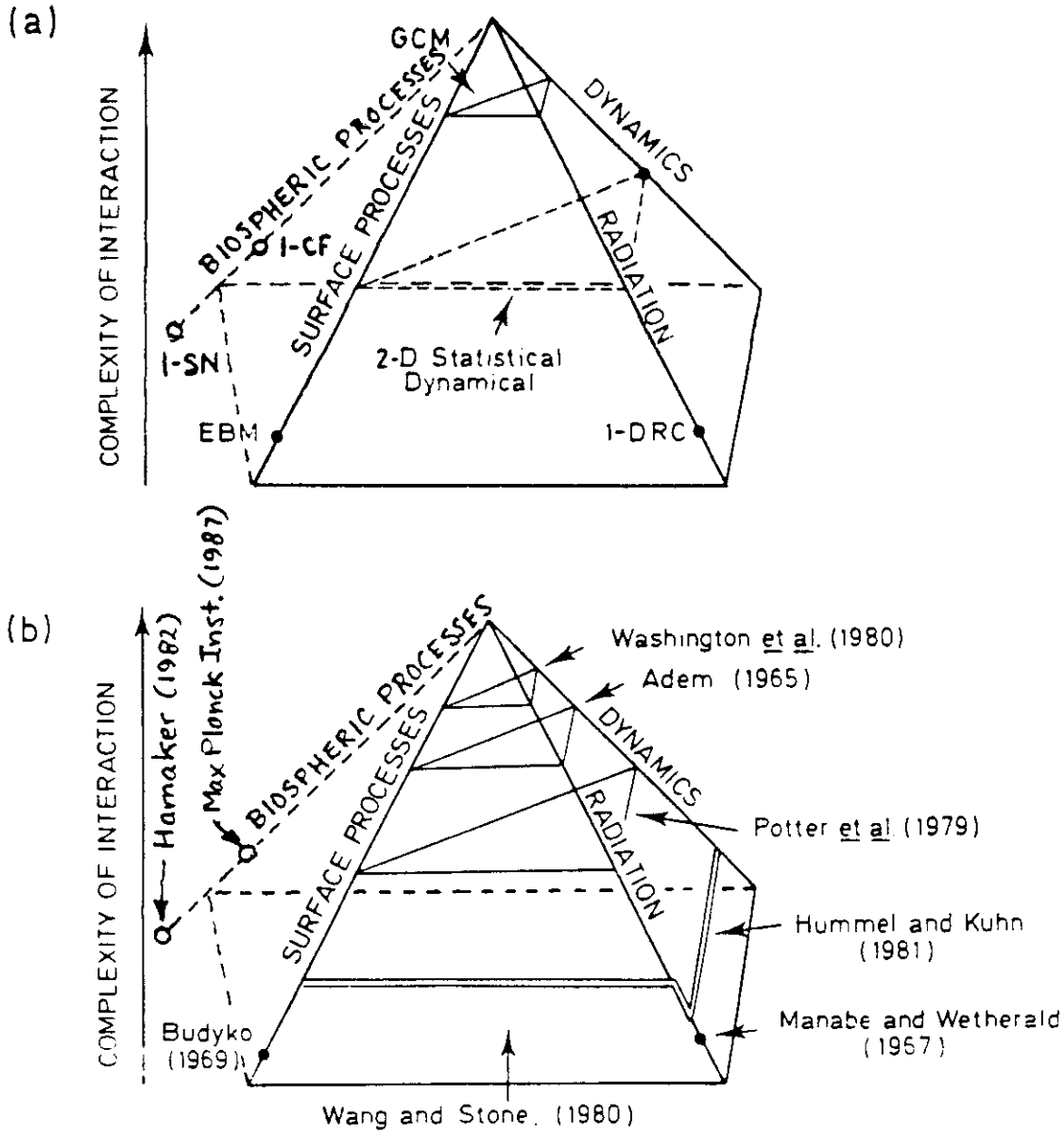


Fig. 1. Climate modelling pyramid. (Modification of diagram from A. Henderson-Sellers and K. McGuffie A Climate Modelling Primer Chichester: John Wiley & Sons, 1988, p. 37.)

## A SAMPLE HAMAKER CIRCLE DIAGRAM OF A GLACIAL CYCLE (15)

A sample Hamaker circle diagram of the glacial cycle is displayed in Fig. 2. The descriptive text is on pages L-31 to L-44 of Ref. 15.

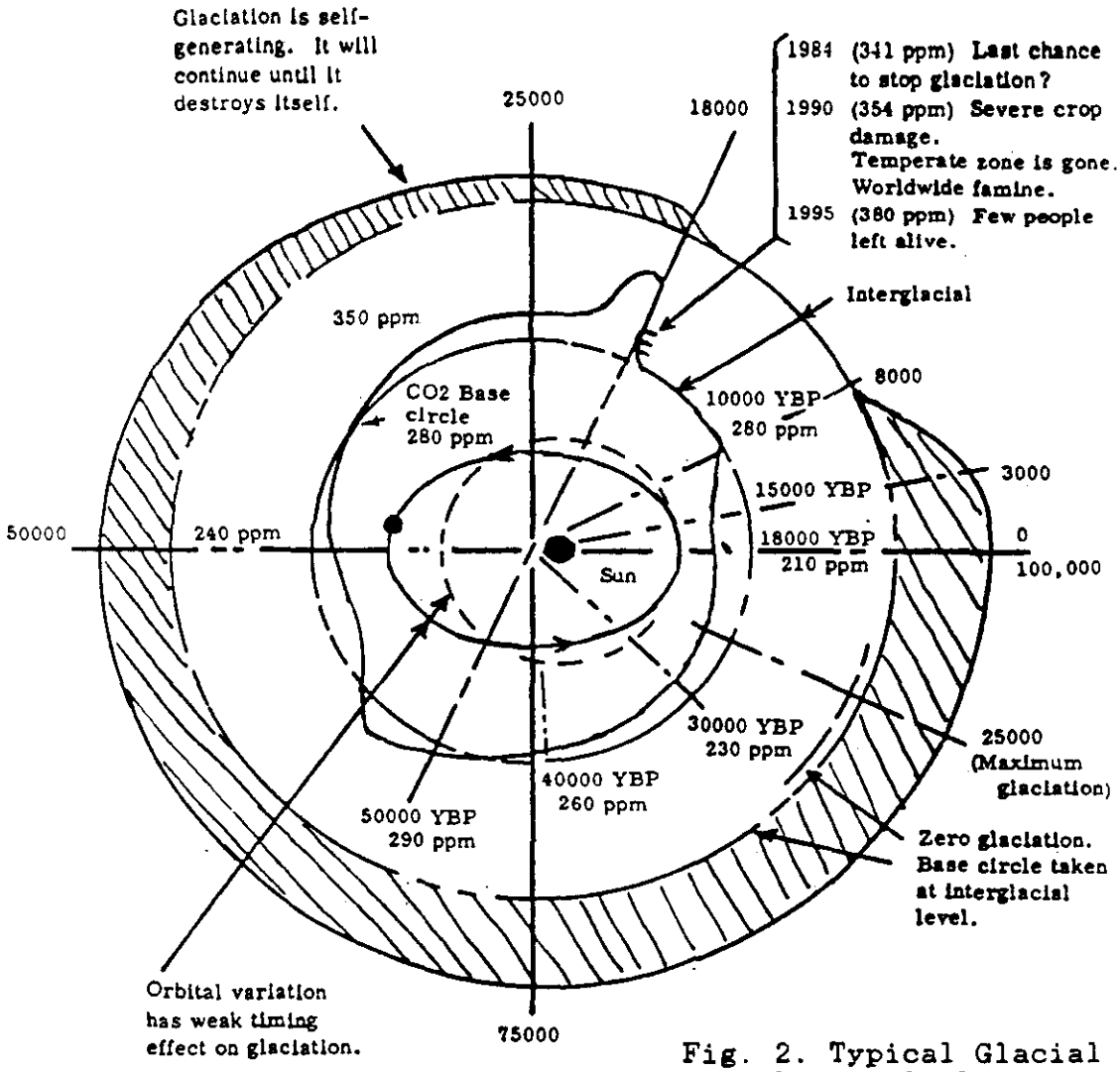


Fig. 2. Typical Glacial Climate Cycle.

## CONCLUSIONS

To carry out my objective to optimize utilization of my skills and experience, I have reviewed how my early MIT Radiation Laboratory experiences can contribute to the climate change research and action program. When connected with the experience of mine, I see that I can help optimally by maintaining a cumulative handbook of a shared strategy of coevolution with the biosphere. I have proposed modifying the climate-modelling pyramid to include a biospheric processes edge. I also am promoting the use of testing of hypotheses as used in theoretical physics to clarify some of the climate change problems. This should help establish a review of the validity of the Hamaker Thesis. I also see how we can use the help of political policy analysts to review the science research policies of the agencies involved in climate change research. I perceive these steps as contributing to a shift in policy from letting the nutrition of the five billion people on our planet go down the drain, to a policy of learning how to substitute a 30-year remineralization of the soil in place of the naturally occurring 90,000-year glaciation process of remineralization.

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