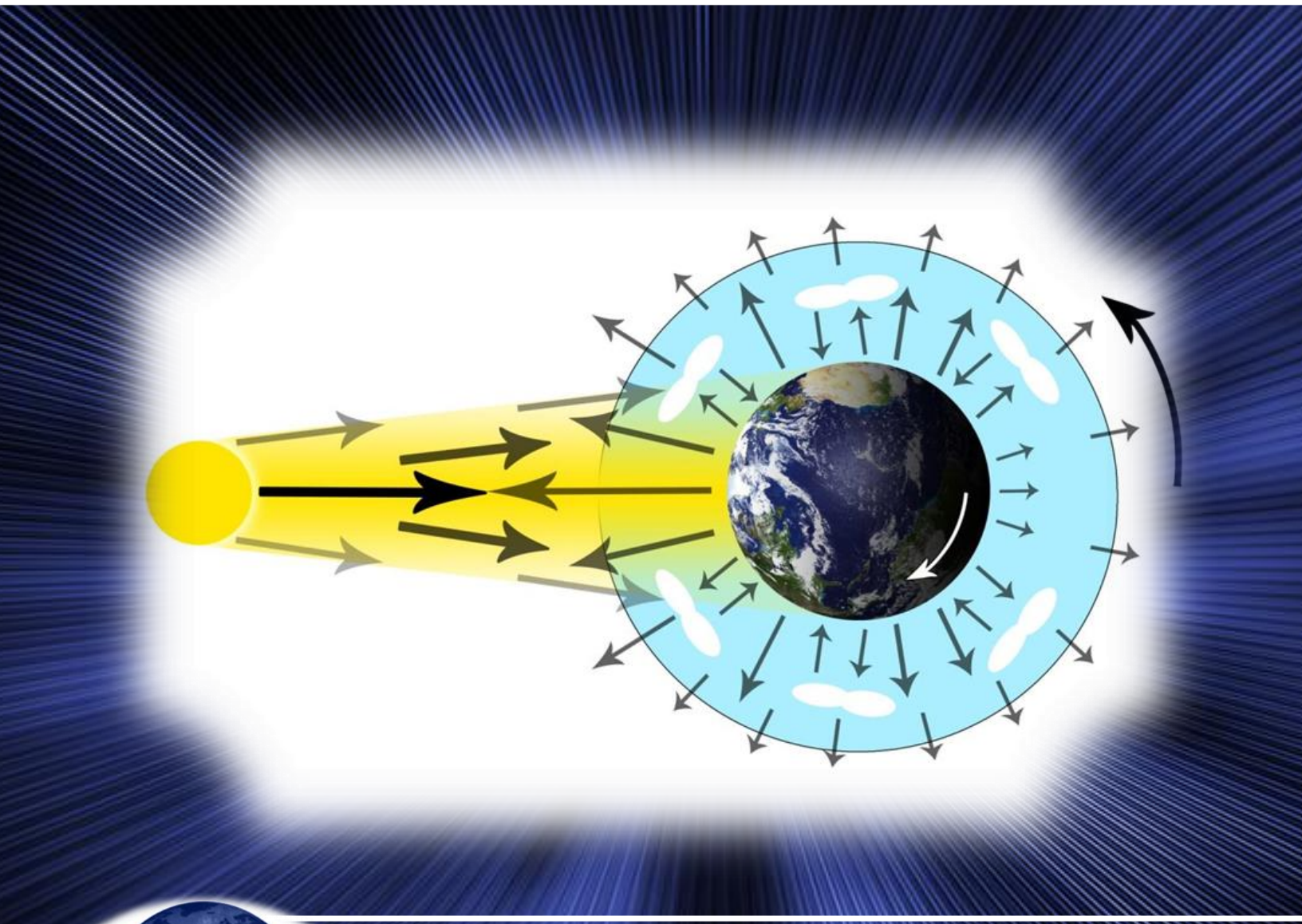
THE REAL CLIMATE

by Vincent Gray



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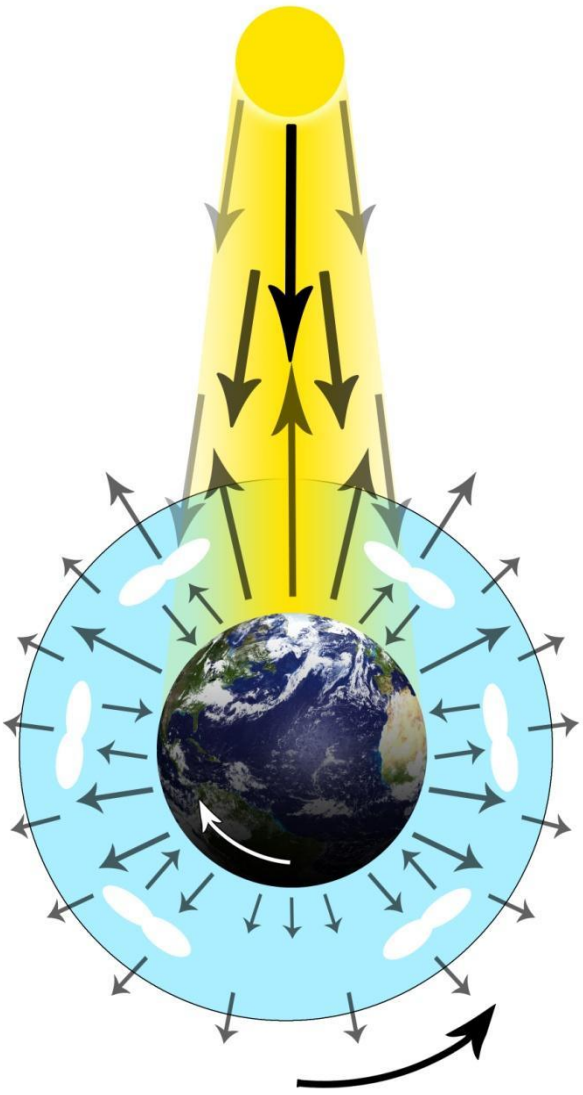

Figure 1: The Real Climate.

PART 1 — THE REAL CLIMATE

The Climate is a heat engine. Energy input is mainly short wave radiation from the sun. Energy output is mainly long wave radiation from every surface on the earth and from every level in the atmosphere, including clouds and aerosols.

The amount of input energy never equals the amount of output energy. Energy can be stored for short or long periods and so can sooner or later be released from storage. Some energy received can be radiated in return by reflection. Some energy that was stored as coal or gas millions of years ago is yet to be released.

Radiation from the sun is only received during each day, as the earth rotates on its axis and follows its orbit around the sun. It ceases altogether at night.

The amount of radiation from the sun begins at dawn from zero to a maximum at noon and declines to zero at sunset and depends on latitude and the seasons.

The energy received depends on the absorption and reflection of the sun's rays by clouds, overcast periods, or aerosols that are present on that particular day. These are currently not capable of accurate prediction or averaging so that the radiation received cannot itself be accurately determined. The energy received depends on individual values of the albedo at each point.

The radiation received follows several different paths.

Some is absorbed by the surface and is transmitted into it, depending on its local thermal conductivity. Over the oceans, or lakes, transmission is disturbed by fluid motion in the area, both above and below the surface.

Some of the energy absorbed will transfer heat by conduction to the neighbouring layers of the atmosphere, which will rise by convection, influenced by local topology and by local wind speed and direction.

Some heat is removed by evaporation of water from damp ground or from oceans and lakes. Wind speed and direction enhances the process, so that when combined with convection the air may sometimes be warmer than the ground.

Some energy is radiated from the surface. At night, radiation depends on heat absorbed the previous day. Some energy is radiated from every level of the atmosphere

Atmospheric circulation distributes heat and moisture across and around the surface, reducing the difference between the tropics and the poles and up into the atmosphere as far as the tropopause.

At night, circulated air may reduce heat loss by conduction or by deposition of dew or frost.

Heat is also distributed by ocean currents which form in recognised fluctuating patterns.

Water vapour from the earth condenses to clouds as soon as it reaches the dew point. The latent heat is deposited in the atmosphere at this region, thus increasing the slope of the lapse rate.

Some clouds form rain, hail or snow, which is deposited on the earth's surface, but not necessarily in the place where it came from. Since it comes from a cool part of the atmosphere, it usually cools the surface on which it falls. With snow this may persist over time, abstracting further latent heat when a period of thaw ensues.

The density of the atmosphere falls with height from reduced gravity and it cools adiabatically. This fall of temperature with height is called the Lapse Rate. The return of latent heat by clouds causes a decrease in this rate. In addition, there are effects from convection, radiation loss and latitude. Figure 2 shows only the adiabatic and moisture effects.

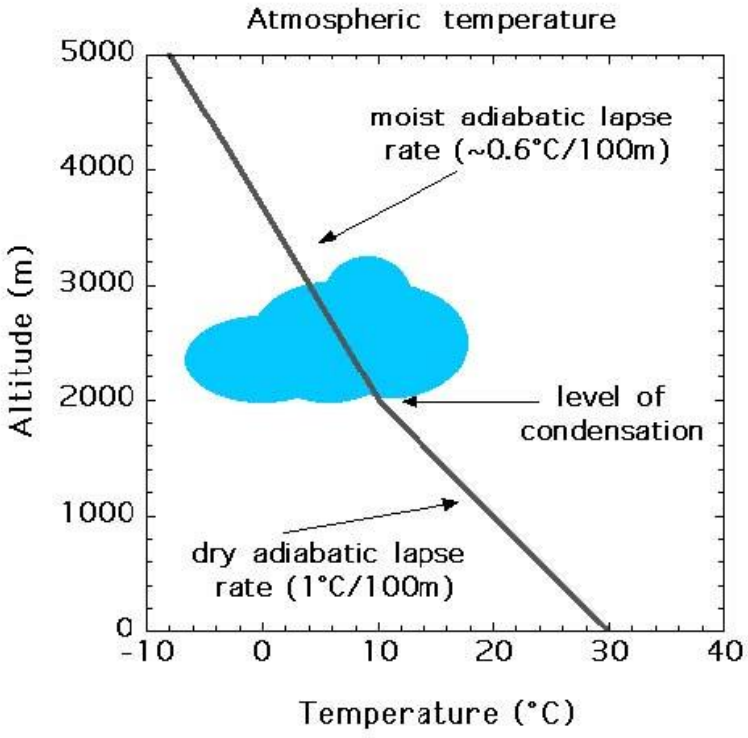

Figure 2: Dry and Moist Adiabatic Lapse Rate.

The surface of the earth and every level of the atmosphere radiates energy according to the Stefan Boltzmann Law, dependent on emissivity multiplied by the fourth power of the absolute temperature. The lapse rate means that the radiated energy from the atmosphere falls very rapidly with height, so that most of it comes from close to the surface.

Radiation from the surface is upwards, but from the atmosphere it is in all directions, so that half of this radiated energy returns to the surface. By land, the amount returned depends on local albedo, but there is evidence that this is very low over the ocean where most is reflected.

Energy is consumed by changes in the earth's surface, by erosion, glaciers, waterfalls and the effects of cyclones and tornadoes. Energy is used to maintain and increases all the living organisms on the earth, some of whose products can be stored for small or long periods. Stored energy from the past, such as from fossil fuels, may be restored. Some energy may also come from within the earth, as with earthquakes and volcanoes, or from nuclear power.

Humans modify their personal climate by: erecting buildings which exclude the wind and rain, adjusting temperature and lighting, and providing living and sleeping business or recreational facilities. Individual designs depend on local climate, availability of building materials, and level of prosperity.

METEOROLOGICAL SCIENCE

The scientific study of the climate began, as with other disciplines, by the measurement of its properties. This began in ancient times, but has greatly increased with the development of modern science.

Scientific method usually demands that experimental measurements must be reproducible, impossible for climate observations, which are always transitory and cannot ensure standardised instruments, procedures, supervision, or location, over periods of time.

Despite these limitations, measurements of an increasing number of climate properties have been developed into world meteorological service with a daily global picture of the climate able to provide future predictions.

These predictions are limited to a few weeks because of the complexity of the climate and our limited knowledge of the fundamental properties of fluids, often described as chaotic.

TEMPERATURE

Local temperature is a basic requirement. Land measurements were traditionally measured only as maximum daytime and minimum nighttime temperatures. In some form of shelter, Sea Surface Temperature may be from ships or from satellites.

Weather balloons or radiosondes measure atmospheric properties.

ATMOSPHERIC CIRCULATION

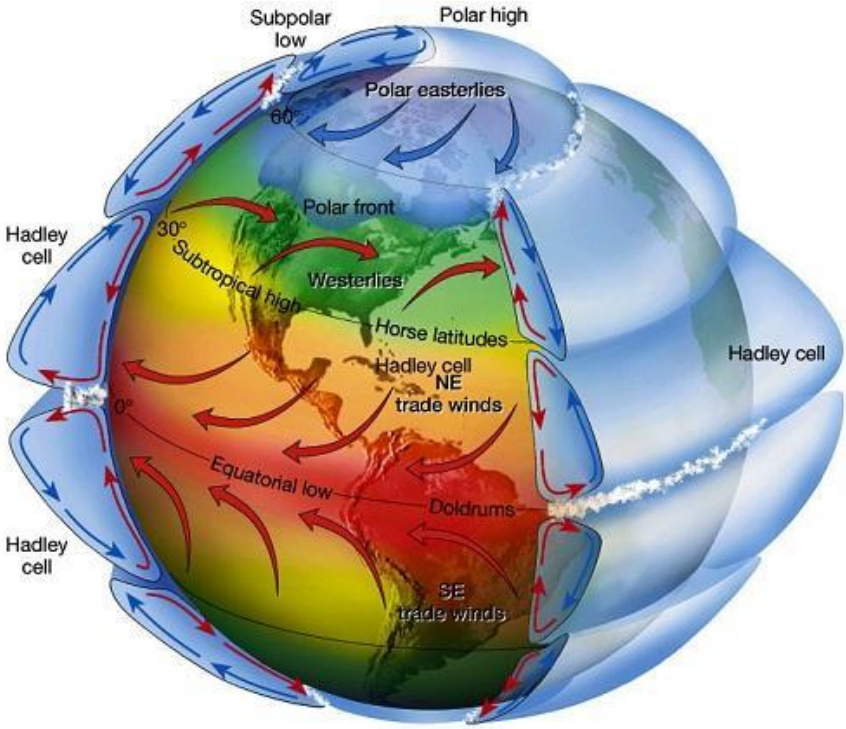

Figure 3: The Circulation System.

The complex patterns of the circulation of the atmosphere are the main determinants of the behaviour of the climate in every locality. The above diagram shows some of the main patterns that have been identified and classified.

AIR PRESSURE: CYCLONES AND ANTICYCLONES

The basic instrument for air pressure is a barometer. A cyclone is a rotating area of low pressure, where the flow is inward toward the center. An anti-cyclone is the opposite, where flow is outward from the center. For atmospheric cyclones and anticyclones, over the northern hemisphere, air flows counter clockwise around cyclones, and clockwise around anticyclones. In the southern hemisphere, it is just the opposite.

Cyclones usually provide wet windy cold weather. Anti-cyclones go with warm sunny weather.

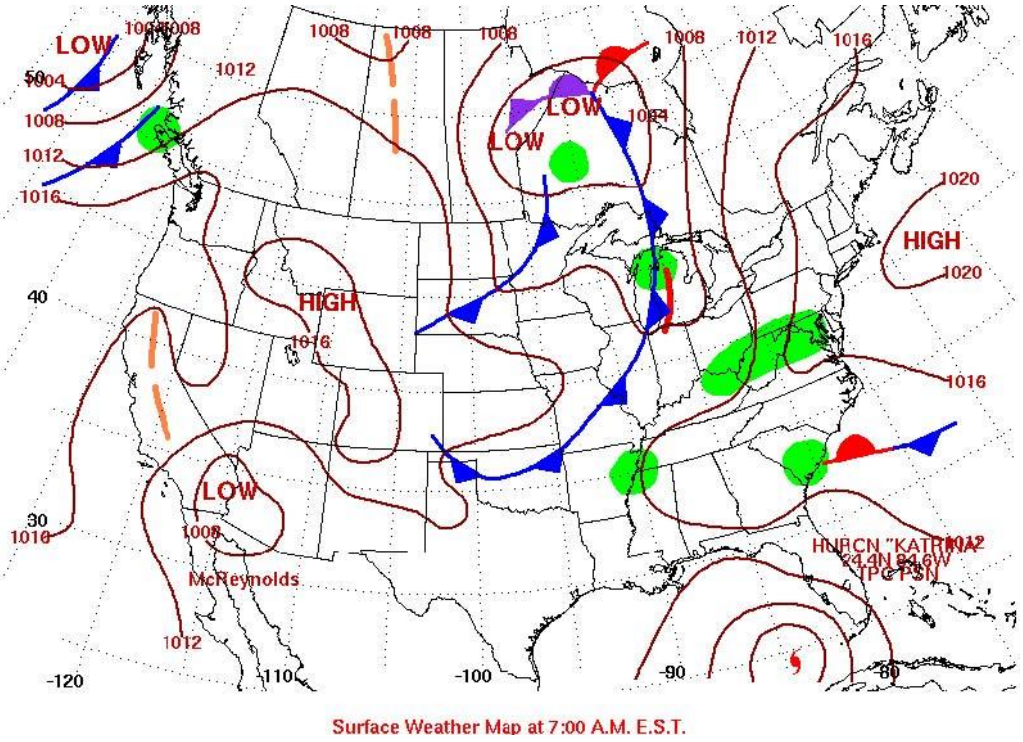

Figure 4: Typical Weather Map Showing Air Pressure.

OCEAN CIRCULATION

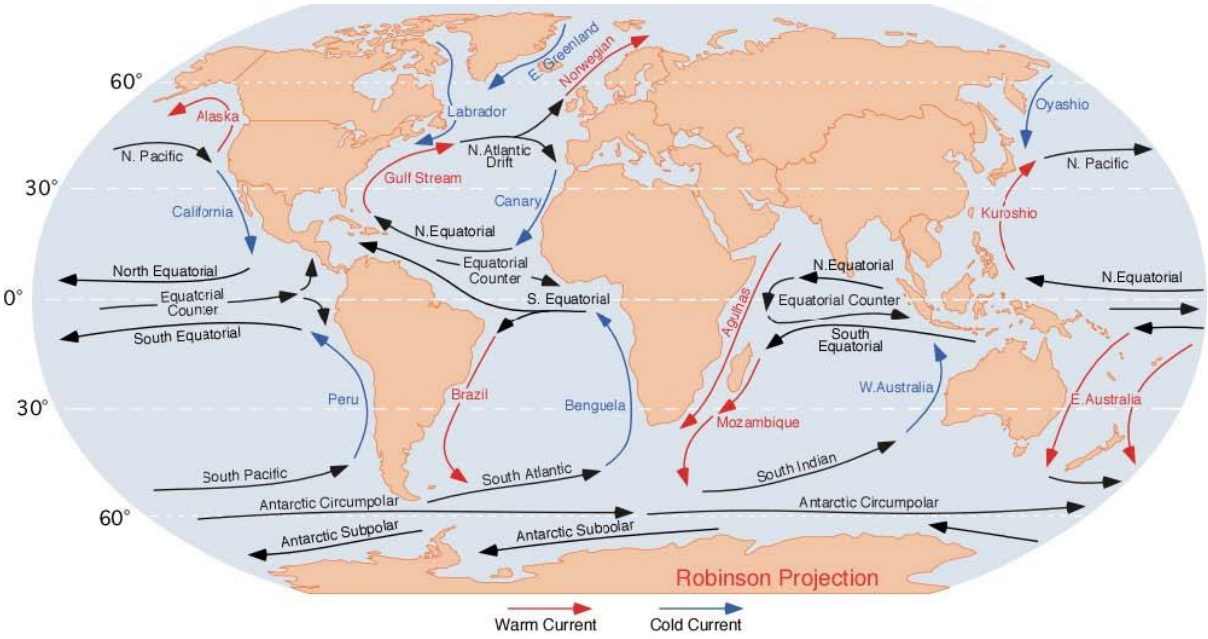

Figure 5: The Main Elements of Ocean Circulation.

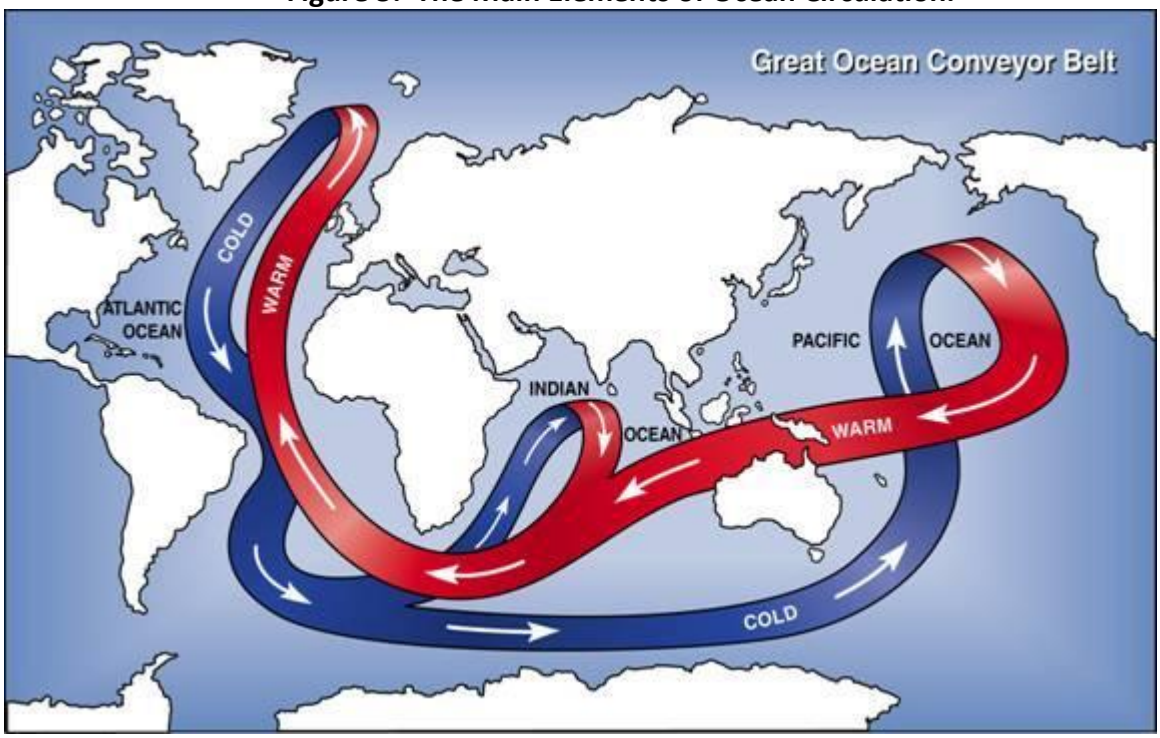

Figure 6: The Great Ocean Conveyor Belt.

OCEAN OSCILLATIONS

The principal oscillations are:

- El Niño/Southern Oscillation (ENSO) – which is observed in the southern Pacific and has a periodicity of 3 to 8 years.
- Pacific Decadal Oscillation (PDO) – which is observed over the whole Pacific hand has a periodicity of two or three decades.
- North Atlantic Oscillation (NAO) – which is observed over the northern Atlantic Ocean and has a period of around one decade.

Other oscillations affect the Arctic, Antarctic and Indian Oceans.

ENSO has a global effect on the climate. The PDO influences the Arctic ice cover.

THE REAL GREENHOUSE

A Greenhouse is designed to encourage plant growth. It also has as a main function: the exclusion of the external climate with its wind, rain and temperature variation. It has a glass

roof to supply the input of the sun's radiation when available. The climate inside retains several features of the outside climate. When the sun shines, radiation is absorbed by the earth and plants which are heated. As with the outside, they are immediately cooled by convection and by evaporation of water. Since the air is confined by the structure, it cannot mix with the outside atmosphere – so the temperature inside is above the temperature outside. As the structure is not insulated, some of the heat will be transferred outside by conduction. At night, or when the sun does not shine, the whole structure and its contents will cool. Temperature adjustment may be made by ventilation or internal heating.

PART 2 — THE UNREAL CLIMATE

An alternative view of the climate has recently arisen from the environmental movement, which believes human activity can be shown to cause all changes in the climate – natural causes being merely responsible for "variability".

As there was no evidence to support this theory, the Intergovernmental Panel on Climate Change (IPCC) was established by the World Meteorological Organisation and The United Nations Environment Programme in 1988 to assess scientific evidence and formulate response programmes. It has supplied four major Reports and several minor ones, and is currently engaged on its fifth Report.

THE UNREAL GREENHOUSE: THE GREENHOUSE EFFECT

The unreal Climate theory is referred to as "The Greenhouse Effect". It is based on a false theory of the action of a greenhouse by Fourier, who speculated that a greenhouse was heated by reflection of infrared radiation from the soil from the glass of the greenhouse. This false theory is used to justify a similar behaviour in the atmosphere.

Fourier[1-10] (1768-1839) made major contributions to the theory of heat flow in solids and to the mathematical simulation of irregular behaviour, but he lived before the discoveries of the mechanical equivalent of heat and the nature of radiation in the later part of the nineteen century.

He believed the earth was heated by the ether but needed extra heat to explain the difference between the tropics and the poles.

His friend de Saussure[11,12] had invented a Hot Box which was a small insulated greenhouse which could be heated by the sun's rays. Fourier[4,6,7] thought that when the sun's rays were changed into non-luminous heat (infrared) when they meet the surface, the infrared rays could not leave the hot box because they were unable to pass through the glass window the box, and so were concentrated inside the box.

Fourier then speculated that there may be some similar mechanism above the tropics which

delayed the departure of infrared rays.

Fourier undoubtedly claimed a mechanism, whereby infrared radiation might be prevented from loss from the atmosphere, by some sort of concentration of the atmosphere, which resembled the action of a glass of a greenhouse, but was a mechanism that applied only over the tropics and he had no knowledge of the possible influence of trace gases in the atmosphere.

Tyndall[14-17] (1820-1893) also believed in an ether. He passed infrared radiation through a brass tube filled with a number of gases and vapours, and measured the amount of radiation absorbed compared with dry air. He included "carbonic acid" but found that even small amounts of water vapour had an overwhelming effect over all the others.

He then speculated that water vapour might show an absorptive effect on infrared radiation from the earth as indicated by Fourier and Pouillet[18-20].

Arrhenius[21,22,26-33] (1859-1927) published a paper in 1865 where he calculated the absorption by atmospheric trace gases by using the measurements of Langley[23-25] of the infrared radiation from the moon from different angles. However, he failed to follow the advice of Tyndall that only water vapour was involved, and assumed that the absorption he calculated was caused by carbon dioxide. Unfortunately, Langley's equipment did not measure the main absorption band of carbon dioxide, so Arrhenius's calculations were actually water vapour and not carbon dioxide. They were also very inaccurate[33].

Despite this error, Callendar[34] presented a paper in 1938 based on it, claiming the influence of atmospheric carbon dioxide as responsible for warming the earth.

The comments of Sir George Simpson, then Head of the British Meteorological Office on this occasion, are worth quoting.

> "*It is not sufficiently realised by non-meteorologists who come for the first time to help the Society in its study that it was possible to solve the temperature distribution in the atmosphere by working out the radiation. The atmosphere was not in a state of radiative equilibrium, and it also received heat by transfer from one part to another. In the second place, one had to remember that the temperature distribution in the atmosphere was determined almost entirely by the movement of air up and down. This forced the atmosphere into a temperature distribution which was quite out of balance with the radiation. One could not, therefore, calculate the effect of changing any one factor in the atmosphere, and he felt that the actual numerical results which Mr Callendar had obtained could not be used to give a definite indication of the order of magnitude of the effect.*"

The First IPCC Report[35] (1990) presented what it called "the Greenhouse Effect" in this simplified diagram on page XIV of the Policymakers Summary.

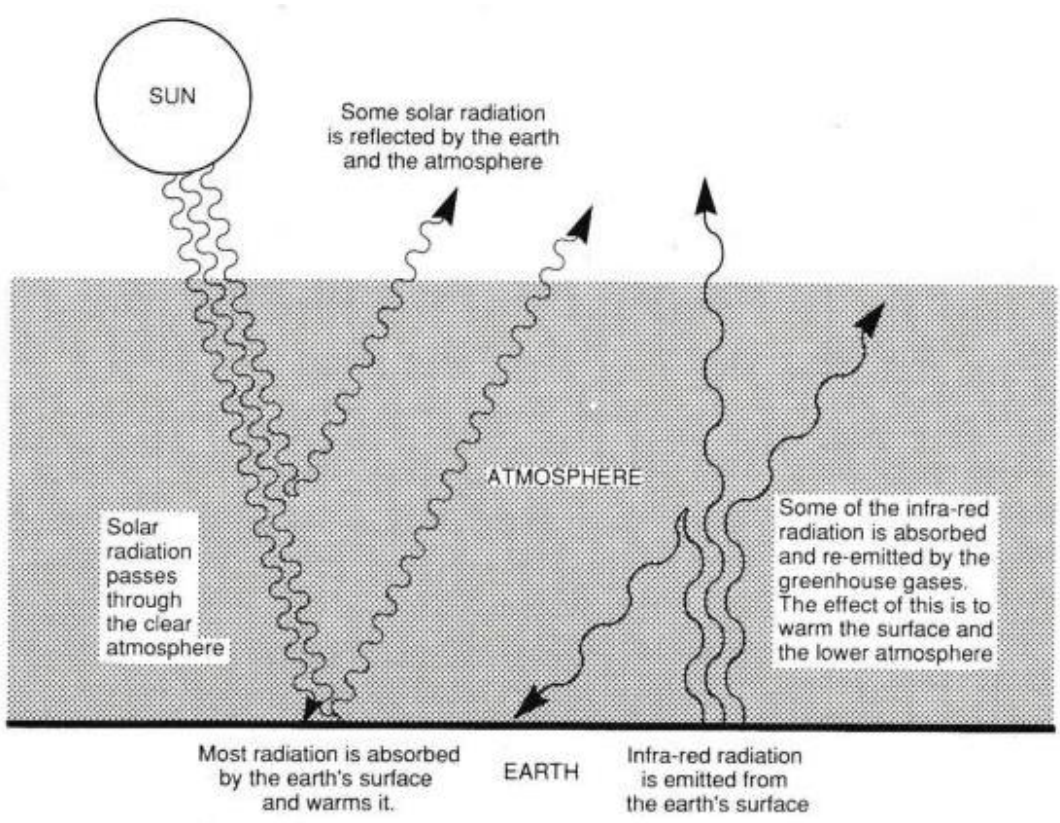

Figure 7: The Greenhouse Effect[35]

This model has hardly anything in common with the Real Climate.

Its assumptions include the following:

- ✓ The earth is flat.
- ✓ The earth does not rotate.
- ✓ The sun shines all day and all night with equal intensity.
- ✓ Energy interchange in the climate is entirely by radiation.
- ✓ Conduction, convection and latent heat transfer do not happen.
- ✓ Energy flow parameters are constants with no variability.
- ✓ Energy flow is "balanced" with input equal to output.
- ✓ Air movements, wind, rain, hurricanes are ignored.
- ✓ Chaos has been abolished.
- ✓ Change in this system is entirely caused by increasing human-induced trace gases in the atmosphere.
- ✓ The earth is dead: there are no living organisms, no trees, animals, birds or people.

The IPCC[36] chooses to deal with only part of the total climate – what it calls "the climate system". This is defined as follows:

"The **Climate System** is the highly complex system consisting of five major components: the *atmosphere,* the *cryosphere,* the *lithosphere,* the *biosphere* and the interactions between them".

This climate system does not include the other components of the real climate, which are the sun, the earth and outer space.

The contributors to the IPCC Reports are evidently unhappy with their unreal model.

The Fourth IPCC Report[36] has the following version, as published by Trenberth, Fasulla and Keihl[37]:

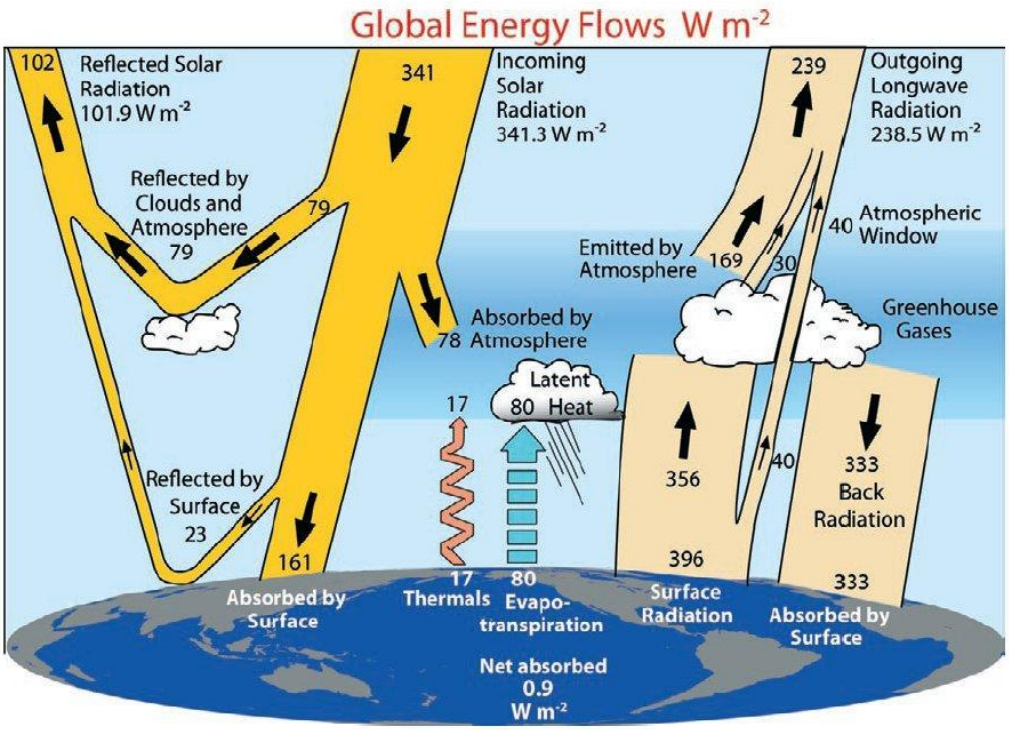

FIG. 1. The global annual mean Earth's energy budget for the Mar 2000 to May 2004 period (W m^{-2}). The broad arrows indicate the schematic flow of energy in proportion to their importance.

Figure 8: Figure 1 from Trenberth, Fasullo and Keihl[37]

Near the beginning, this paper states: "For an equilibrium climate the outgoing long wave radiation necessarily balances the incoming absorbed solar radiation". It then goes on to admit there are many reasons why this is not true. These include: scattering and reflection of incoming radiation by clouds and aerosols, absorption by the atmosphere, and the transfer of

absorbed heat to kinetic energy and latent heat. They also admit that energy may be stored for some time or be converted to other forms of energy.

The above diagram, which assumes constant values for all the assumed energy transfers, shows a global energy imbalance of +0.9W/m^{-2}, presumably a result of the mentioned additional disturbing factors. If their figures are realistic, this means that the earth is warming without increases in greenhouse gases.

The Report itself[36] makes the following claim in "Frequently Asked Questions" No 2:

"The chaotic nature of the weather makes it unpredictable beyond a few days. Projecting changes in climate (i.e., long-term average weather) due to changes in atmospheric composition or other factors is a very different and much more manageable issue."

It is evident they have "managed" the problem of chaos by pretending it does not exist as shown by Figure 7.

A revision of this "Energy Balance" diagram, in the Fifth Report of the IPCC[37], complicates the matter still further.

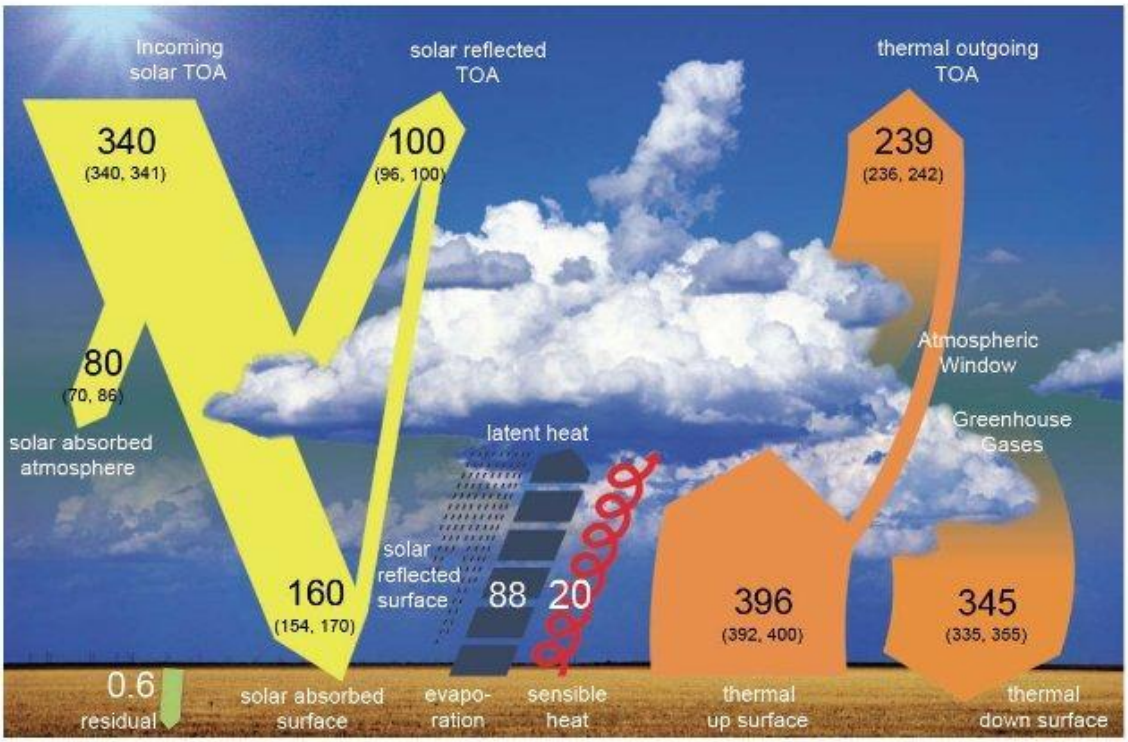

Figure 9: Most Recent Version of the IPCC Model[38]

They have changed several of their chosen figures, but they now admit that the figures chosen are more or less arbitrary choices from a range of published estimates which they now add to the diagram. The overall imbalance is now slightly reduced to +0.6W/m^{-2} but the quoted wide

ranges must mean there is a considerable inaccuracy in this figure, depending on which of the figures might be correct. It confirms that the earth is probably warming, but it could be much higher than this, or even cooling instead.

Changes in energy on the surface itself include: formation of living organisms, recovery of stored energy by the combustion of fossil fuels, nuclear energy and the energy required to alter or erode the surface by the action of wind, oceans and glaciers.

If the Climate is treated as a heat engine, with the energy input radiation from the sun, exhaust as radiation from the earth, and the atmosphere to space, the product of the engine is the totality of living organisms.

Heat engines create negative entropy on their product which thereby is a storage of energy, but the overall process has to comply with the Laws of Thermodynamics. The energy stored in the biosphere is partly recovered by the decay of dead organisms. This is often slow and incomplete and its remains may represent recoverable energy.

According to the latest IPCC estimate, the energy received on the earth's surface from the sun is 160 Watts/m^{-2}. If this is multiplied by the seconds in a year ($3.15X10^{7}$) and by the square meters on the earth's surface ($5.1 X 10^{14}$) we get $2.6 X 10^{24}$ joules per year.

According to the BP Annual Review 2012, the total annual world energy consumption in 2011 was 12476.6 Million Tonnes of Oil equivalent; consisting of 4130.5 oil, 3987.1 gas, 5720 .1 coal, 791.5 Hydro, 599.3 Nuclear, and 194.8 Renewables. If you separate the fossil fuels, you get 11837.7 Mtoe. Multiply by $42X 10^{12}$, it gives $5.0 x 10^{21}$ joules per annum.

This is about 0.2% of the input from the sun.

If all this energy was released as heat, it would amount to an additional annual global imbalance of +0.32W/m^{-2}, 13% of the supposed +2.4 W/m^{-2} now claimed[38] to originate from greenhouse gases.

As I pointed out in the similar calculations I published in my book: The Greenhouse Delusion (2002)[37], most of the energy is released over large industrial regions of Europe and North America, where the local input is close to the supposed greenhouse effect.

World energy consumption currently increases annually by about 2.5%, so its influence increases.

In addition to energy from fossil fuels, more input comes from changes in the earth (e.g., nuclear power, geothermal and volcanic). Some energy would be used to erode the surface under the action of wind, sea and glaciers.

The energy imbalance of the earth is probably positive, but also extremely uncertain, so that the IPCC Climate model, as shown by Figure7 and also by the recent update (Figure 8), is quite

incapable of giving guidance on the possible role of greenhouse gases in modifying the climate. Kevin Trenberth himself has correctly summarized the situation with the remark he made amongst the Climategate Emails; that the models are a "Travesty".

On Oct 14, 2009, at 10:17 AM, Kevin Trenberth wrote:

"Hi Tom How come you do not agree with a statement that says we are nowhere close to knowing where energy is going or whether clouds are changing to make the planet brighter. We are not close to balancing the energy budget. The fact that **we can not account for what is happening in the climate system** makes any consideration of geoengineering quite hopeless as we will never be able to tell if it is successful or not! It is a travesty! Kevin"

Who could disagree with him?

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Vincent R. Gray, M.A., Ph.D., F.N.Z.I.C.
Climate Consultant

75 Silverstream Road Crofton Downs Wellington 6035, New Zealand
Phone: 064) (04) 9735939

Email: vinmary.gray@paradise.net.nz