Water Dipole and Climate of the Earth

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Abstract - Without our atmosphere, the mean temperature on Earth should be -18 °C. With our atmosphere in fact the mean temperature is +15 °C. This very important phenomenum is due to one « greenhouse » effect. Our atmosphere contains locally between 0.4 to 4 % of water vapor : it is the principal actor of this « greenhouse » effect (50 to 60 % following different climatologists). But the last reports (2010-2018) of GIEC (International Group for the Evolution of Climate) or IPCC (Intergovernemental Panel on Climate Change) are claming that the increasing of carbon dioxide during the industrial period (1750-today) from 300 ppm to 400 ppm is the principal actor of the Earth Global Warming. The reasons evocated by the GIEC are : the water cycle is very short (one week) but the life time of carbone dioxide is long (one century). On our planet water quantity is constant and is not considered as an anthropic gas. It is very surprising to read all these assertions.

So, to clarify them, we'll analyse the total absorption electromagnetic spectra of H_2O and CO_2 (from 0.6 micron to very far infrared) to show that the water dipole has an absorption area much more large and much more active than the symmetrical dioxide molecule one. If you take into account all the total quantity of water (oceans, vapor, clouds, rains, watering, anthropic origin…) the conclusions show that water (after the sun) determines the climate of the Earth.

Keywords - water dipole, greenhouse, electromagnetic absorption, climate

I. Introduction

Following last reports of IPCC (Intergovernmental Panel on Climate Change) without our atmosphere, the mean temperature on the Earth should be −18 °C (Appendix I). With atmosphere it is +15 °C. This effect is due to one greenhouse effect: it allows the life. It is linked with infrared absorption of the gas in atmosphere (essentially H_2O and CO_2).

The greenhouse effect is explained here: Earth surface is heated with the short waves (around 0.5 micron) given by the sun (with some reflections), then the warm surface reemits this energy with long waves (Infrared around 10-15 microns).

The greenhouse gas absorb and then reemit these infrared waves increasing the warming of the Earth atmosphere so in infrared [1].

Today the global warming of the Earth is recognised everywhere. The different reports of GIEC (International Group for the Evolution of Climate) and IPCC give an increasing of the mean temperature about 0.8 °C and forecast an increasing of several degrees in future (2050). These groups explain that the carbon dioxide is the principal actor concerning this increasing because its concentration has evaluated strongly (from 300 ppm to 400 ppm) during the last centuries where the industrial activity has been developed very well (from 1750 to 2019). However, these groups say that the greenhouse effect is due to 60 % by H_2O, 20 % by CO_2, 8 % by O_3, and 6 % by $N_2O + CH_4$ [2]. But the relative concentration increasing of CO_2 is the strongest during the last centuries (+30 %) and so it is the principal cause of the global warning. In fact, these groups assert the concentration in water is stable and the water cycle is very short (one week) while the CO_2 which is the main anthropic gas has a cycle long (100 years) [1].

These assertions must be discussed: first, water vapor is the principal greenhouse gas in atmosphere (concentration between 0.4 % to 4 %) and then it is so an anthropic gas (we have produced in same time water and carbon dioxide in combustions). To say that its concentration is stable locally seems problematic. More, the oceans contain an enormous quantity of water and play an important role on the climate of our planet [2].

Therefore, it is necessary to analyse deeply the electromagnetic spectra of water and carbon dioxide and to understand the effects of the water on the climate considering the entire water on the Earth.

II. Spectra absorptions

A. H_2O

The water molecule is a strong dipole with the value 1.84 Debye: the distance O-H is 0.9564 Å and the angle between the two O-H is 104.45°, we have calculated the equivalent charge on each H, it represents 0.527 of elementary charge.

Due to this very particular structure this light molecule contains a very great number modes of vibrations symmetric asymmetric and bend in electromagnetic spectrum. But its very small moment of inertia on rotation gives rise to reach combined vibrational and rotational spectra containing tens of thousands of absorption lines.

Calculations give theoretically [3-5] 20 modes of vibrations corresponding to wavelengths from 0.6 micron to 10 microns and so 32 modes of rotations corresponding to wavelengths from 10 microns to 500 microns. In fact, it appears in our atmosphere experimentally 10 absorption bands in visible and large bands from 1.0 microns to infrared (Fig. 1). But, so water absorbs in short waves (the clouds are grey and sometime almost black) and so in infrared and far infrared to very long waves giving 12 248 sites to 2 GHz (see micro waves cooking at 2.45 GHz) [6].

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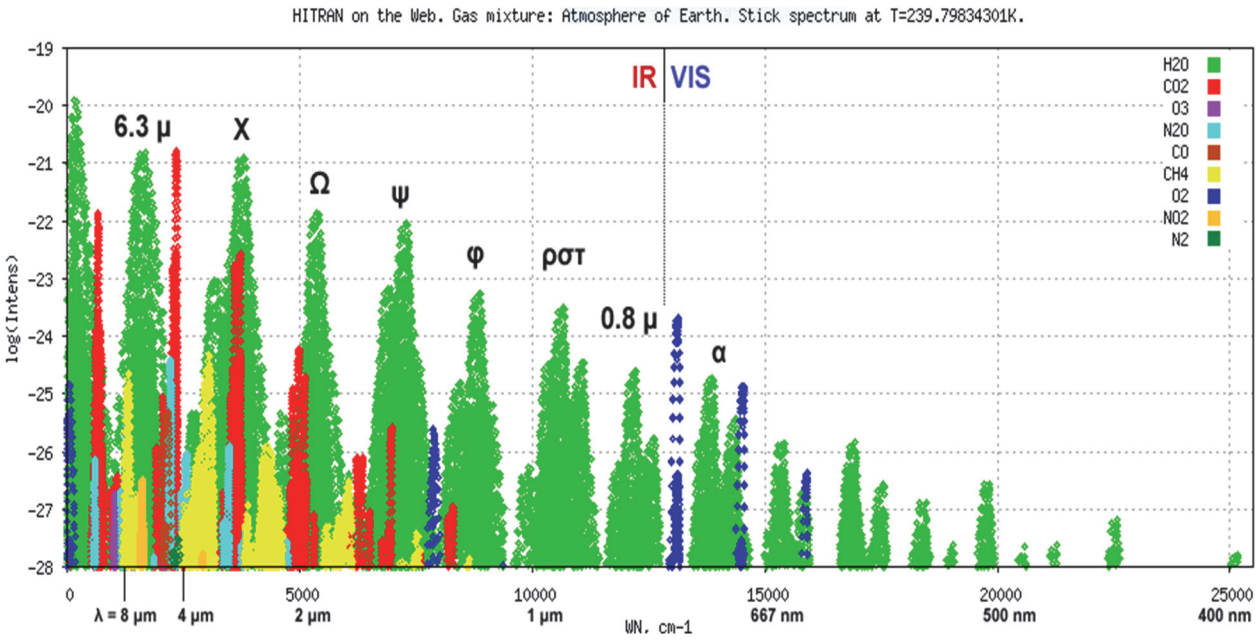

Fig. 1. Electromagnetic absorptions of atmosphere gas after HITRAN (C C)

B. CO_2 molecules

On the contrary the carbon dioxide molecule is not a light polar molecule and has essentially 4 absorption bands in infrared (IR):1.80 micron, 2.0 microns, 4.3 microns, 15 microns [4], as shown on Fig. 1 given by HITRAN

C. Comparison

The total effect of absorption is essentially due to the water vapor in particular in the visible, infrared, far infrared and very far infrared.

On Fig. 1, we can see that water vapor has 10 absorption bands (0.55-0.70 micron) in visible. So, a very great energy is taken by the water directly from the sun in air. Ozone has some absorption.

So during the sunny day, it appears that the sun activate the water essentially in our atmosphere.

From data [3-6] it is easy to calculate in considering the total absorption areas that the energetic effect ratio between water vapor and CO_2 is at least 10. Taking account into the concentrations between water and CO_2 in atmosphere is from 10 to 100 following the regions (desert, poles, equator), we deduce that the total energy ratio between water and carbon dioxide for the atmosphere is between 100 (dry air) and 1000 (humid air).

GIEC and IPCC do not value to this effect for the water pretexting that the concentration of the vapor is too varying. Their reference is CO_2 with a ratio of 1 compared to others gases (CH_4, O_3, NO…) only [1].

Then, an interesting aspect of the heat absorption by the humid air is the variation of the specific heat with the water concentration. Dry air has a specific heat of

1.0 kJ kg^{-1} K^{-1}. Strong humid air (ratio 0.001 in weight) reach 3.0 kJ kg^{-1} K^{-1}. The specific heat of carbon dioxide is only 0.6 kJ kg^{-1} K^{-1} and has few action on air like said previously. The atmospheric pressure has a gradient and the Laplace law permits to calculate the thermal gradient in troposphere. This gradient is linked with presence of water (Appendix (II)) [11].

III. Effect of the Liquid Water

The particular structure of the water molecule induces other important effects on the climate. This particular structure is due the O-H link (hydrogen bond).

In the liquid a cluster of several molecules are formed and bring new vibration modes increasing the absorption [7-11]. More, this hydrogen bond has an energy of boiling of 2264 kJ kg^{-1}, and a heat capacity (specific heat) of 4185 J kg^{-1} K^{-1}. So these strong energies allow a great absorption in oceans coming from the sun.

The oceans cover more 72 % of the planet surface and their depth can reach several kilometres. So, they accumulate an important quantity of heat (1000 times more than atmosphere). The evaluations are about several hundred zeta Joule: 10 times the energy consumed by the humanity per year. In fact, it is concluded that first the sun warms directly the Earth by the water. This accumulation allows the climate regulator for our planet. But they can so provoke many disasters.

When the temperature of water reaches about 28 °C, it appears the possibility to form the hurricanes during a long time with the vapor which is absorbing and then recovering still more energy by raining (condensation). Therefore this hurricane grows up and continue to grow up to the lands where the source of water disappears (end of run away).

The clouds (other water concentrations) absorb the sun energy and create a local cooling following the altitude where they are.

In fact when the evaporation is strong the creating of clouds limits the solar energy: it is the second aspect of climate regulator of water.

Concerning the ice the structure is like a hexagonal crystal due to the structure (Handbook of Chemistry and Physics). The weak melting energy is 334 J/g. The density of water is maximum at 4 °C due to the O-H bond which is maximum at this temperature: this effect allows the life in deep water. The ice is a good thermal insulating and protects the deep water of freezing. When the pressure increases this weak link disappears and the glaciers basis are melting in iceberg and fall down. So, the water is not concentrated in poles.

Concerning the liquid water this surface tension is the greatest among the liquid. We remark that the water has the greatest boiling and melting temperatures.

We add another effect: the lightning in the clouds. For us, the quick crystallisation of the ice contains many electrically charged defects. In the cloud the wind moves the insulating lumps of ice and the numerous chocks fracture the ice and give much little lumps charged positively or negatively. When the electric field reach locally the Paschen field (ionisation field), the lightning is appearing.

IV. Discussion on the Climate

We have seen that the water has a fundamental role on the climate on our planet (particular structure numerous sites of absorptions and great quantity in ocean).

But for the GIEC it is CO_2 which is responsible of planet warming because it is growing while the water is stable [1].

For the GIEC the greenhouse effect due to the water vapor is recognised as important (50-60 % only) but stable because the cycle of water is short (one week) while the cycle of carbon oxide is long (one century). It is said that we have created a lot of CO_2 in industrial period giving a concentration of 0.04 %. But so the water vapor has been created in this same industrial period. The chemical reaction with coal, gasoil, petrol and oxygen give water in mean half of weight of CO_2. The GIEC does not give no information about it, evocating the short cycle of the water. If we use the GIEC data, 545 Gt of CO_2 have been produced for 1870, to day 230 Gt are added in the atmosphere, 155 Gt are added in ocean and 160 Gt in the lands. Therefore, 270 Gt of new water have been produced in the same time. Total water in atmosphere is 12 900 Gt, so this new water represents a ratio of 2 %. Certainly, a great part was absorbed by plants forest wastes and rivers, but if we want to explain an increasing of mean temperature of 0.32 % (0.8 deg K on 285 °K), this phenomenon must be considered because the water compared to CO_2 has the energy ratio greater than 100.

We have seen that the oceans play a very important role with one mass of 1.4×10^{21} kg (300 times atmosphere mass) [12]. It is the greatest tank of heat of the planet. The sea currents (surface and depth) are now studied and the cycle of water is in fact very long. It is not one week as said by IPCC but in hundred years. [12] The effects of temperature and salinity gradients provoke several sea move called upwellings and downwelling which act as a convection effect to heat the sea in depth. So certain effects (El Nino, El Nina) begin to be explained, but the study will take a long time (Fig. 2). The ocean is therefore the second source of heat after the sun.

The climatic phenomena (overflood, hurricanes…) registered today are local and depending of the water concentration in this region.

Another important new phenomenon is the watering for the cultivations. This quantity is enormous: 250 Gt/year (more 20 % of phreatic layer) and principal use of water (USA, China, where some rivers are drained). This quantity was multiplicated by 4 for 1960. So, the cultivation ratio was multiplied by 10 and by this way decreasing the CO_2 but increasing locally the vapor of water from 4 to 6 %. So, with the strong watering from 1960, the electromagnetic absorption of air has increased. On Fig. 3, historic humidity anomalies are presented from 1971 to 2012 on land and ocean.

Another important factor for the climate is the albedo: it is the reflecting ratio of the electromagnetic waves. For the earths is about 20-30 %, snow and ice: 75-95 %, ocean: 2-7 %.

About the cultures, albedo varies from 15 to 25 %. With the development of culturing (green space) the albedo

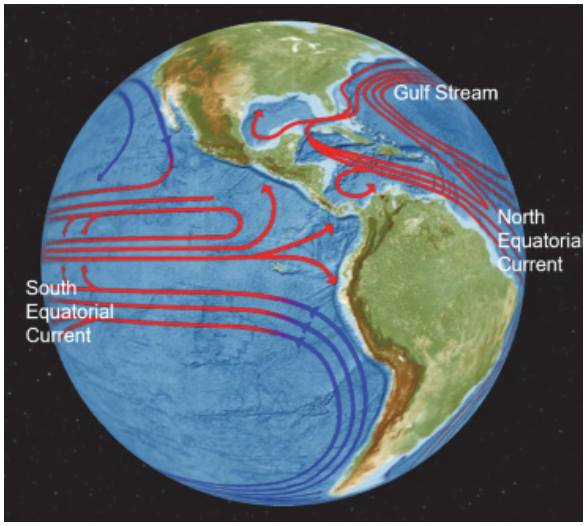

Fig. 2. Oceanic Currents
(given by National Oceans Service)

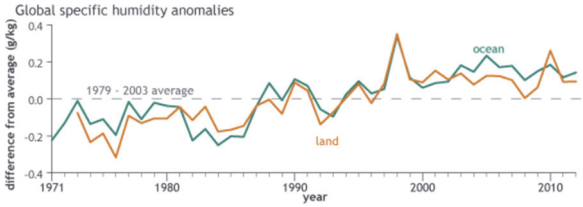

Fig. 3. Historic humidity anomalies
(given by National Oceanic and Atmospheric Administration)

decreases and contributes to the global warming (Appendix I).

So, it appears the great complexity of the climate: variation of parameters on the Earth (humidity, clouds..), but so the cycles of the sun (11, 22, 60 years…), inclination of Earth axis [13].

Today some authors begin to critic so the theories of GIEC or IPCC [14-16] on the climatic models and even the greenhouse effect saying that is impossible for the atmosphere to heat the Earth because it is cooler.

V. Conclusion

The predictions for the climate in short duration of some ten years are very difficult, because the enormous quantity of water plays a fundamental role: by electromagnetic absorption: direct effect from the sun (in visible) and greenhouse effect in infrared and far infrared. The climate seems chaotic because many phenomena are active (humidity, clouds, oceanic currents...) and very long to study. But the particularity of the water molecule form (dipole and lightness) allows the life on the planet Earth.

The carbon dioxide cannot play the important role given by IPCC and GIEC, the water is the second heat source after the sun and could be responsible of global warming of Earth.

To understand the mechanism of the global warming to day, it is necessary to study the great accumulation of heat in the oceans and the exchanges atmosphere-sea.

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Appendix

(I) Solar flux F_o at the top of the Earth: 1365 W m^{-2}
Stefan constant *st*: 5.67×10^{-8} W m^{-2} deg^{-4}
Mean Albedo *A* of the Earth: 0.30
Radius *R* of the Earth:
Equation giving the Equilibrium of Absolute Temperature without atmosphere:
Power by radiation Planck = Power received by the sun
$4\pi R^2 stT^4 = (1-A)\pi R^2 F_o$
$T = 255\ ^{\circ}K = -18\ ^{\circ}C$ [1,2]

(II) Thermal Gradient of the Troposphere:
Due to the gravitation g:
$dT/dz = -g/C_p$
g = 9.81 m s^{-2};
Specific Heat of air C_p = 1005 J kg^{-1} deg^{-1} for dry air, 1510 J kg^{-1} deg^{-1} for humid air. So, this gradient varies between −6.5 deg kg^{-1} and −10 deg kg^{-1} for humid and dry air [11].