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Earth's ices melting: and if the greenhouse effect of anthropogenic CO₂ is not the (only) cause?

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Abstract: The all-sided information provided by greenhouse gas experts is disturbing. Future ocean level and atmosphere temperature raises are assigned to an increase of "greenhouse effect" due to the surplus of carbon dioxide (CO₂) of anthropogenic origin. Reducing the fossil sources of CO₂ is therefore the recommended solution. However, the related dogma is subject to polemics. As an alternative, the present approach is based on the exploitation of twelve facts and not on assumptions and calculations. It is shown that a minimal estimate of the global thermal energy consumed in 2018 (0.1 Zj) and the estimated heat necessary to melt the ices that disappeared during the year (0.08 Zj) are of the same order of magnitude. This observation suggests that the greenhouse effect of fossil CO₂ is not necessary to explain the disappearance of ices. The discussion shows that taking into account the generally neglected anthropogenic heat and the water phase-transfer equilibria may explain the discrepancy observed between the rather small variations in average atmospheric and oceanic temperatures and the considerable ices melt. It is shown that the increases of total energy, of anthropogenic heat and of melted ices exhibited the same trends over the 2000-2018 period of time. A few years should be enough to confirm or invalidate these trends. In case of confirmation, replacing the fossil sources of energy by other sources to limit climate changes may turn to be ineffective if these new sources supply equivalent amounts of heat. It is the controls of population and of its bulimia in energies that will have to be promoted.

Keywords: Climate changes, fossil sources of energy, anthropogenic thermal energy, greenhouse effect, CO₂ anthropogenic sources.

1. Introduction

As a neophyte in climate change prediction, the chemist I am is puzzled by the information that is disseminated by greenhouse gas experts and is revived at every turn by the media, politicians, environmentalists and various associations. What do we hear? "Climate changes are caused by an increase in the natural "greenhouse effect" due to an increase of carbon dioxide and to some other atmospheric greenhouse gases (methane from herbivorous animals and from natural gas, and even nitrous oxide N₂O of whipped cream). These increases are said causing planet heating via infrared radiations and are all related to human activity. Decreasing the sources of anthropogenic CO₂ is thus the systematically and universally recommended solution.

However, there seem to be arguments against the surplus of greenhouse effect evaluated on the basis of questionable hypotheses and calculations. For instance see (<http://www.global-warming-and-the-climate.com/arguments-against-global-warming.html>); and (<https://skepticalscience.com/does-greenhouse-effect-exist.html>). Opponents to the greenhouse effects (climate-skeptic) contest predictions based on hypotheses and calculations and emphasize the absence of correlation between the present small atmosphere and ocean temperature increases and the relatively important ices melt. Misunderstanding of some fundamentals of infrared electromagnetic waves with molecules are also opposed

(<https://towerofreason.blogspot.com/2018/04/co2-is-not-driving-global-warming.html>). From what I know about the absorption of visible and ultraviolet electromagnetic waves by the atoms and electrons of chemical functional groups present in organic molecules, I was unable to find flaws in the argument of the latter contribution relative to the limits of CO₂ radiative heating effects. In general, what is missing in these critical arguments are consideration to conductive effects related to conductive heat and counterproposition to the “greenhouse effect dogma.

Let's forget the polemics and the religion-like arguments to try an alternative based on facts.

1.1 The facts

1) It is becoming more and more evident, especially over the past decade, that glaciers are regressing, permafrost is melting and the polar ice caps are decreasing, all in acceleration <https://www.pnas.org/content/116/4/1095>;

2) The natural greenhouse effect is largely dominated by the atmospheric water vapor major in quantity and efficiency compared to the small increase in CO₂ actually measured;

3) The annual temperature variations of the oceans and the atmosphere in the hemispheres are mainly dependent on the Sun through the capture of its thermal energy and its irregular cyclic emissions.

4) When two media are brought into contact with each other, the hottest transfer heat to the coldest and the temperatures of both change in opposite directions, except if the transfer is dominated by interphase equilibrium ;

5) Anthropogenic sources of heat include animal and human metabolisms, combustion of oil-based products, natural gas and biomass, activity of nuclear and thermal power plants, and machines using electricity;

6) All sources of energy are not equivalent. When burned in the presence of atmospheric oxygen (O₂) coal (C) generates hot carbon oxides (CO and CO₂) but no primary hot water vapor. In contrast, the combustion of hydrocarbon sources composed of carbon and hydrogen (oil, peat, lignin, natural gas, wood, and even animal and human metabolisms) generates CO₂ plus water vapor both generally hotter than the atmosphere. In all cases, atmospheric oxygen is consumed. There is indeed a slight decrease in its proportion in the air and in the oceans over the years (https://cdiac.ess-dive.lbl.gov/trends/oxygen/modern_records.html). As for the production of electrical energy by nuclear power plants and by renewable resources, it does not generate CO₂ but it generates heat immediately during the production and later on during the exploitation of electricity (electric radiators, TVs, lightings, smartphones, etc., all heat). Even electric trains and cars give off heat. So all sources of heat and not just fossil fuels disperse heat into the atmosphere and more generally into the environment;

7) In 1900, the world energy consumption (not primary energy supply which is larger) corresponded to about 1100 megatons of oil equivalent (Mtoe) (coal 480, oil 25, gas 5, and biomass 580). In 1950, the figures were respectively 2158, 955, 505, 153, 545 with the addition of electricity for 29 (total doubled in 50 years). In 2000, the respective figures were 9242, 2116, 3542, 2026, 465, and 1096 (<https://www.encyclopedie-energie.org/consommation-mondiale-denergie-1800-2000-les-resultats/>) which corresponds to

a 5 fold increase in 50 years. In 2018, the numbers were: 13865, 3917, 4474, 3360, about 250, about 2000 (i.e., 50 % increase in eight years and 1200 % in 100 years) (https://fr.wikipedia.org/wiki/Ressources_et_consommation_%C3%A9nerg%C3%A9tiques_mondiales). Evaluating the total energy consumption from Mtoe data which depend on the sources is just as approximate as evaluating the greenhouse effect attributed to atmospheric CO₂ (https://en.wikipedia.org/wiki/World_energy_consumption). Anyhow, based on 13865 Mtoe consumption in 2018 and 1Teo = 4.18x10¹⁰ j (joules) equivalence, it is assessable to about 0.5 Zj or 0.5 x 10²¹ joules of which we retain only 20% (0.1 Zj) as minimal dissipated heat energy in absence of data. Contributions from previous years are certainly lower but nevertheless cumulative. Where did this huge heat energy go?

8) Although invisible, both the hot combustion gases and the electrically heated air cool more or less quickly by thermal energy transfer to the environment. In general, nothing is seen but the water vapor becomes visible if it is cooled rapidly. In winter, it can be seen from lung exhalation, from the car exhausts at the start or in the upper atmosphere behind planes. It is the same from the evaporators of nuclear plants topped with large clouds;

9) Carbon dioxide and condensed water cooled to ambient temperature are partly integrated into the management of corresponding atmospheric pools. CO₂ is captured by seas, by some alkaline minerals and by plants with regeneration of oxygen (inverted lung) while condensed water is managed by terrestrial absorption, by ice formation, by evaporation ↔ condensation equilibria involved in the formation of clouds and rains, or by reintegration into natural living matter via biochemistry;

10) Chemistry teaches that in a closed world like Earth “nothing is created, nothing is lost, everything is transformed” (even electromagnetic radiations through absorption, transmission and refraction phenomena), whereas physics teaches that: a) solid ↔ liquid (ice ↔ water liquid) and liquid ↔ gas (vapor then clouds then rain to buckle) equilibria consume or generate thermal energy according to the direction they move, and b) such interphase equilibria always evolve at constant temperature, that is to say without temperature change during the energy transfer (the ice in a glass of water melts to bring and maintain the temperature of the water at 0°C but the phenomenon is slow and the temperature of the atmosphere above the glass can be 30° C in summer). In humans and animals, perspiration and evaporation are used to maintain the temperature of the organism fixed (37 ° C for man) and to eliminate the internal or external heating of this organism;

11) On 2019, huge quantities of fossil energy sources (actually solar energy stored in the far past) have already been consumed and transformed in parts as heat, water, CO₂ and biomass. Larger quantities of thermal energy sources are still stored (oil, coal and gas) or are going to be produced (electricity), which will supplement the previous contributions of heat in the lower atmosphere.

What can be said from these facts in relation to climate change? Nothing if the anthropogenic heat energy is neglected or negligible, except calling on greenhouse effect to the chagrin of climate-skeptic people.

Can the anthropogenic thermal energy be really neglected?

If the answer to this question is no, a reason must be found that account for the discrepancy between the rather small effects on atmosphere and oceans temperatures and the melting of polar and terrestrial ices now established, for sure, as important and growing.

Logically, the contradiction can be assigned to the fact that atmosphere and oceans temperatures depend on the physical equilibria introduced at # 10, at least basically. In the past, the anthropogenic energy was negligible and only the Sun heated the atmosphere with reversible ice melting and atmospheric heating over summers and winters and alternately in the northern and southern hemispheres, greenhouse effects included. Nowadays, anthropogenic heat diffused in the environment complements that of the Sun and is involved in the same processes. As with solar energy, anthropogenic heat depends on ice ↔ liquid water ↔ water vapor ↔ liquid water (cloudiness, rainfall) equilibria that are theoretical sources of temperature constancy. These interdependent physical equilibria control the thermal energies on Earth by evolution in one direction or the other depending on the amount of negative or positive heat to be managed. Theoretically, the global temperature should remain balanced. However, the Earth is very large and complex and submitted to chaos. In reality, what is observed are temperature wells and peaks, formations and disappearances of clouds, floods and droughts, etc., whose opposite thermal effects should compensate at the level of the globe. However, the fluctuations are far from the thermodynamic equilibria scientists play with in a laboratory. Slow transitions and turbulences of air and water (low atmospheric pressures (humid air) and high pressures (dry air), high winds, heavy rainfalls, hurricanes, oceanic streams Labrador and Gulf stream, Niño and Niña, summer and winter, etc.) make the evaluation of global averaging difficult. In contrast, solid ices are not dramatically disturbed by turbulences though their fusion depends on them. It is therefore preferable to monitor the annual differential formation-disappearance of ices (in mass and not in surfaces) to try predicting the evolution of the planet climatic environment on the basis of thermodynamic phenomena. Whether the thermal energy to be absorbed comes from an excess of greenhouse effect or from the anthropogenic thermal energy, or from both, the trend is clear: on continuous heating the buffering effect of ice melting will be progressively transferred to the buffering effect of evaporation-condensation transitions involving water.

Anthropogenic energy and disappearance of ices.

An assessment of the thermal energy absorbed by ices melt in 2018 can be made on the basis of the annual mass loss averaged over 6 years, i.e. 240×10^{12} kg (https://www.planetoscope.com/rechauffement/1077_ice-melting-in-Antarctic.html) and the melting heat of ice, i.e. 333.55×10^3 j per kg. We obtain a value of 8×10^{19} j (0.08 Zj) close to the minimal thermal energy of anthropogenic origin evaluated as (0.1 Zj) # 7. According to this approximation, the 5th of anthropogenic energies consumed was enough to cause the 2018 ices melting without any contribution of the greenhouse effect due to CO₂.

In summary, the preceding analysis leads to attributing the slight increases in air and ocean temperatures detected until now to a control of the anthropogenic thermal energies by the equilibria involving the solid, liquid and vapor water. According to this logic, anthropogenic thermal energies transfer by atmosphere and by oceanic water turbulences are sooner or later going to be absorbed by the melting of ices, something which is predominantly observed today. The oceanic waters and the atmosphere act only as means of heat transferring the slow rate of which leading to instable temperature increases. Since anthropogenic energies are managed by these intermediaries, turbulences previously due to the Sun activity (hurricanes, thunderstorms, tornadoes, oceanic movements) should increase in strength and frequency

locally without affecting importantly and permanently the present global oceanic and atmospheric temperatures. There already seems to be signs in this direction. So far, the few tenths of a degree Celsius and the few cm raises of atmospheric and oceanic averages may be another version of the half-full or half-empty bottle ambiguity, meaning that small deviations from normal levels or signs may be or not future dramatic deviations. This ambiguity fueled the polemics relative to climate evolution. In the far future, when all the ices disappear, the absorption of anthropogenic heat will be supported by the only water-vapor-condensation equilibria which will evolve towards the formation of more and thicker clouds which will reflect more and more the dominant Solar energy relative to anthropogenic heat and thus will cause a surface cooling of the Earth with, at the end of the process, reformation of the ices.

If this is the future, what should we do?

If the global anthropogenic heat energy does play the significant role proposed above, replacing the fossil sources by other sources of energy to keep the global energy consumption growing without CO₂ production may appear like plaster on a wooden leg. As a matter of fact, the Earth looks like a cancerous body and the tumor may be called humanity because of a quasi-exponential growth of population and a bulimia of energy whose negative effects on the planetary balances go get worse if nothing is done. The treatment may be at the level of a reduction of the anthropogenic CO₂ that actually results from the demand in energies but it is the origin of the related harm (the total anthropogenic heat energy dissipated in the environment) and therefore the excessive demand for energy that will have to be treated. To repel the described evolution, the economy will have to be curbed in order to reduce the production of goods and energy-consuming means that the need for remunerative work and the lure of profit make excessive. Greenhouse effect or not, it appears necessary to act without waiting for Nature to limit the human population and its worship of consumption. The far end would be disappearance as it was for dinosaurs in the past when the atmosphere was so hot that some reptiles were living in ice-free northern Greenland. Fortunately it is not for soon. In a close future, the buffering effects of ices, ocean water, and atmospheric evaporation-condensation should continue to keep ocean and atmosphere temperatures globally stable even if enhanced local fluctuations are observed. It is probably a matter of centuries but it is better to anticipate. Presently, the growths of global heat consumption, ices melting and anthropogenic heat show similar trends (Fig. 1) whereas the atmospheric temperature remained stable between 2000 and 2014 (<http://berkeleyearth.org/2018-temperatures/>).

These trends are not proofs but a few years will be enough to confirm or refute these tendencies and thus the value of the role assigned above to thermodynamics and physical phase-transfer equilibria, especially if ices melt progresses while sources of anthropogenic CO₂ are driven down. Presently the Sun remains master of climate changes on Earth. However the Sun works half day when anthropogenic heat is produced day and night and summer and winter. On another hand, these anthropogenic sources of heat, which are localized in the low atmosphere and predominant in the northern hemisphere, are managed by well-known air and ocean dispatching streams surrounding the Earth. The resulting gradients are just what is needed to stimulate atmospheric and oceanic turbulences that were specific to the Sun in the past.

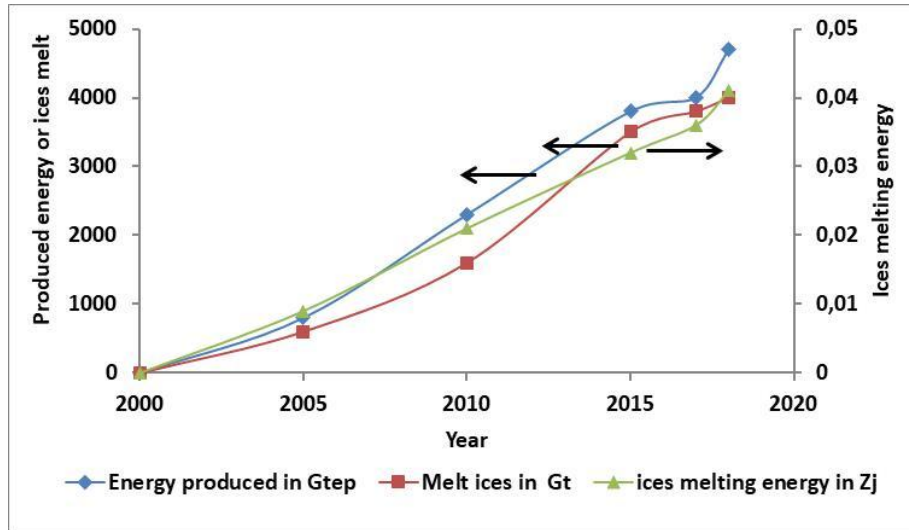


Figure 1: Comparison between the evolutions of the total energy produced (in Gtep), of melted ices (in Gt) and of the heat diffused in the atmosphere (1/5 of the total energy) relative to year 2000 taken as reference (data collected from various internet sources).

Conclusions

The proposed argument based on global data collected via the Internet shows that anthropogenic thermal energy produced in 2018, greatly minimized to 20% of the total, is sufficient to explain the melting of the ices said disappeared in the same year. Complementary or alternative to the effect of anthropogenic surplus of the CO₂ content of the atmosphere, taking into account the regulatory effects of thermodynamic equilibria of water phase transitions leads to the maintenance rather than the increase of global oceanic and atmospheric temperatures while suggesting an increase in turbulent regulatory mechanisms whose local consequences should worsen in frequency and intensity. Confirmed, the role of anthropogenic thermal energy will involve reducing the production of anthropogenic heat energy beyond the sole sources of energy generating CO₂.