

Physical Analysis of Atmospheric Phenomena Associated with Climatic Storms: Approach Study Related to Climate Change on Earth

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Abstract

Atmospheric phenomena are physical phenomena resulting from the correlation of atmospheric parameters of natural origin. They are associated with climatic storms and include lightning, thunder, global warming, wind, evaporation, rain, clouds, and snow. The formation and evolution of these phenomena remain complex according to their natural reference parameters. The numerical models defined in this study are equations based on models of atmospheric parameters. Applied in the atmosphere, they yield the equation of the key atmospheric phenomena. The distribution of these phenomena across the entire planet is the origin of the formation of climatic regions. Indeed, the constants obtained are 275.16 km/s for the speed of lightning, 3.99 GJ for the discharge energy of a thunderbolt, 276.15°K for the temperature of global warming, 3.993 Km/h for the formation speed of winds and cyclones, 2.9963 Km/h for the speed of evaporation, 278.16°K for the formation of rain, 274.1596°K for the formation of clouds, and 274.1632°K for snow formation. Moreover, this research conducts an analytical study approach to the phenomenon of climate change in the current era of industrialization, specifically analyzing the direct effects of global warming on atmospheric phenomena. Thus, with a temperature of 53.45° C, global warming is considered maximal and will lead to very abundant rain and snow precipitations with maximum PW at 12.5 and 11.1 g/cm² of water, surface water evaporation fluxes significantly above normal at a speed of 6.55 Km/h, increasingly violent winds at speeds far exceeding 5.43 Km/h, and catastrophic climatic effects. In summary, the aim of this research is to define the main natural phenomena associated with global climatic storms and to study the real impact of climate change on Earth.

Keywords

Atmospheric Phenomenon, Climate Change, Climatic Catastrophe

1. Introduction

The climatic disasters on planet Earth can involve natural processes due to eruptions of atmospheric phenomena. They are defined as the extreme expression or total absence of atmospheric phenomena within a time interval spanning one or more climatic seasons. However, the signs of climatic disaster are increasingly visible on the Earth's surface through extreme weather events. The planet generates, from atmospheric-origin parameters (dryness, fire, heat, air, humidity, water, cold, and ice), multiple phenomena associated with climatic storms, namely lightning, thunder, global warming, wind, evaporation, rain, clouds, and snow [1]. Among all these phenomena, global warming acts as a catalyst for all processes related to climatic storms [2] [3]. The extreme variation of these phenomena can impact the planet by categorizing it into major and moderate climatic disasters [4] [5]. This article aims to: determine the main atmospheric phenomena related to climatic storms on Earth; derive the equations from the numerical model defining them; and finally, calculate the formation constants of the phenomena governing our planet [6] [7]. This study also includes an analytical section with figures highlighting the unique ambiance of these phenomena in the Earth's troposphere. However, the primary concern of researchers focuses on climates, emphasizing the heterogeneity of atmospheres on the Earth's surface [8] [9].

2. Description of the Physical Model

The physical model defines the set of variations of atmospheric phenomena that occur within the Earth's atmosphere and vary differently according to geographical scales. **Figure 1** shows the distribution of these phenomena in an order established by their main origin parameters, namely vapor, ice, dryness, fire, heat, air, humidity, and water. These phenomena are only a mixture of these atmospheric parameters of permanent origin (**Table 1**).

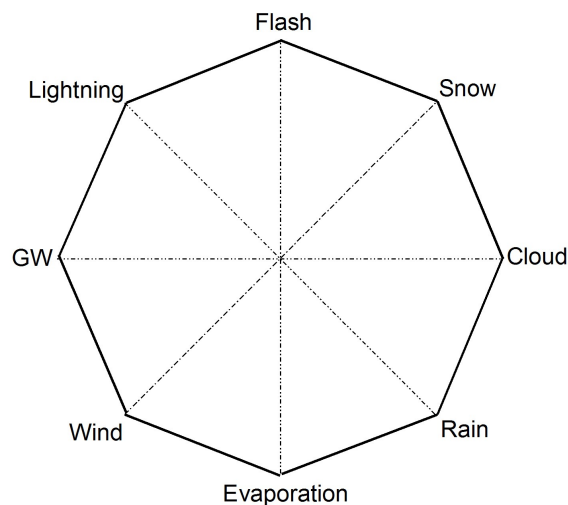


Figure 1. Physical model of atmospheric phenomena.

Table 1. Main atmospheric phenomena.

ATMOSPHERIC PHENOMENA								
Type	FLASH	LIGHTNING	GW	WIND	EVAPORATION	RAIN	CLOUD	SNOW
Original	Dry +	Fire +	Heat +	Air +	Dry +	Heat +	Dry +	Ice +
stimulating	Vapor +	Heat +	Vapor +	Dry +	Heat +	Water +	Heat +	Dry +
parameters	Humidity	Humidity	Humidity	Heat	Humidity	Humidity	Vapor	Heat

+: mixture; GW: global warming.

3. Numerical Results

3.1 Combination of Parameters

Atmospheric phenomena are produced by the combination of atmospheric-origin parameters (Table 1). Table 1 presents eight main phenomena according to these natural atmospheric parameters: thunder, lightning, global warming (GW), wind, evaporation, rain, clouds, and snow.

3.2. Mathematical Formulation of Equations Governing Atmospheric Phenomena

The following numerical models represent the equations of atmospheric phenomena. They are derived from the physical model in Figure 1 and have no application limits. They are written as follows:

Equation for flash

$$E_{Flash} = \left(1 + \frac{1}{1 + \frac{PM}{\rho R}} \right) \left(1 + \frac{PM}{\rho R} \right) \quad (1)$$

Equation for lightning

$$E_{Lightning} = 1 + \left(\frac{1}{1 + \frac{PM}{\rho R}} \right) \left(1 + 3 \frac{PM}{\rho R} \right) \quad (2)$$

Equation for global warming

$$E_{GW} = 1 + \frac{PM}{\rho R} \left(1 + \frac{2}{1 + \frac{PM}{\rho R}} \right) \quad (3)$$

Equation for wind

$$E_{Wind} = 1 + \left(\frac{1}{1 + \frac{\rho R}{PM}} \right) \left(3 + \frac{\rho R}{PM} \right) \quad (4)$$

Equation for evaporation

$$E_{Evaporation} = 1 + \left(\frac{1}{1 + \frac{\rho R}{PM}} \right) \left(2 + \frac{\rho R}{PM} \right) \quad (5)$$

Equation for rain

$$E_{Rain} = 4 + \left(\frac{1}{1 + \frac{\rho R}{PM}} \right) \left(2 + \frac{PM}{\rho R} \right) \quad (6)$$

Equation for cloud

$$E_{Cloud} = \frac{PM}{\rho R} + \left(\frac{1}{1 + \frac{PM}{\rho R}} \right) \left(1 + \frac{PM}{\rho R} \right) \quad (7)$$

Equation for snow

$$E_{Snow} = 1 + \left(\frac{1}{1 + \frac{\rho R}{PM}} \right) \left(1 + \frac{PM}{\rho R} + \frac{\rho R}{PM} \right) \quad (8)$$

Proof of theorems.

Proof of Theorem 1. Note the fact that $(E_{dry} \vee E_{hum} \vee E_{vapor}) \rightarrow E_{flash} \neg$. Theorem 1 is true if $\{x \in \mathbb{R} | x \cong 275.16\}$; $E_{flash} = 275.16 \neg$;

Proof of Theorem 2. Note that $(E_{fiter} \vee E_{heat} \vee E_{hum}) \rightarrow E_{lightning} \neg$. Theorem 2 is true if $\{x \in \mathbb{R} | x \cong 3.9927\}$; $E_{lightning} = 3.9927 \neg$;

Proof of Theorem 3. Note that $(E_{hum} \vee E_{vapor} \vee E_{heat}) \rightarrow E_{GW}$. Theorem 3 is true if $\{x \in \mathbb{R} | 276.15 \leq x \leq 294.5\}$; $E_{GW} = [276.15; 294.5]$, (minimal global warming) \neg and $\{x \in \mathbb{R} | 276.15 \leq x \leq 327\}$; $E_{GW} = [276.15; 327]$, (maximum global warming) \neg ;

Proof of Theorem 4. Note that $(E_{dry} \vee E_{heat} \vee E_{air}) \rightarrow E_{wind} \neg$. Theorem 4 is true if $\{x \in \mathbb{R} | 3.997 \leq x \leq 5.43\}$; $E_{wind} = [3.997; 5.43]$, (wind at altitude) \neg and $\{x \in \mathbb{R} | x > 5.43\}$; $E_{wind} > 5.43$, (surface wind) \neg ;

Proof of Theorem 5. Note that $(E_{dry} \vee E_{heat} \vee E_{hum}) \rightarrow E_{evaporation} \neg$. Theorem 5 is true if $\{x \in \mathbb{R} | 2.9963 \leq x \leq 4.75\}$; $E_{evaporation} = [2.9963; 4.75]$, (heavy water evaporation) and $\{x \in \mathbb{R} | 2.9963 \leq x \leq 6.55\}$; $E_{evaporation} = [2.9963; 6.55]$, (very heavy water evaporation) \neg ;

Proof of Theorem 6. Note that $(E_{dry} \vee E_{heat} \vee E_{water}) \rightarrow E_{rain} \neg$. Theorem 6 is true if $\{x \in \mathbb{R} | 278.15 \leq x \leq 281.15\}$; $E_{rain} = [278.15; 281.15] \neg$, (heavy rain) and $\{x \in \mathbb{R} | 281.15 < x \leq 298\}$; $E_{rain} =]281.15; 298]$, (torrential rain) \neg ;

Proof of Theorem 7. Note that $(E_{dry} \vee E_{heat} \vee E_{vapor}) \rightarrow E_{cloud} \neg$. Theorem 7 is true if $\{x \in \mathbb{R} | 274.159 \leq x \leq 275.16\}$; $E_{cloud} = [274.159; 275.16]$, (thick cloud cover) \neg and $\{x \in \mathbb{R} | 275.16 < x \leq 291.6\}$; $E_{cloud} =]275.16; 291.6]$, (very thick cloud cover) \neg ;

Proof of Theorem 8. Note that $(E_{dry} \vee E_{heat} \vee E_{ice}) \rightarrow E_{snow} \neg$. Theorem 8 is

true if $\{x \in \mathbb{R} | 274.1632 \leq x \leq 278.19\}$; $E_{snow} = [274.1632; 278.19]$, (heavy snowfall) \neg and if $\{x \in \mathbb{R} | 278.19 < x \leq 294.6\}$; $E_{snow} =]278.19; 294.6]$, (very heavy snowfall) \neg .

4. Discussion

Considering atmospheric temperature, the formation of atmospheric phenomena such as clouds, rain, and snow shows an inseparable dependence where the fixed point is the upper cloud, with a maximum height of 4000 meters. Temperature variations lead to the formation of clouds at 274.159°K, snow at 274.163°K, and rain at 278.156°K. **Figure 2** shows the coexistence of the four phenomena at specific points where the constants fix the maximum formation of atmospheric phenomena at an altitude of 4000 meters. The curves present the formation intervals of rain from 1500 to 3750 meters, snow from 1500 to 4000 meters, and clouds from 0 to 4000 meters altitude. The curve representing global warming (GW) sets the formation interval from 0 meters above sea level to 4500 meters altitude.

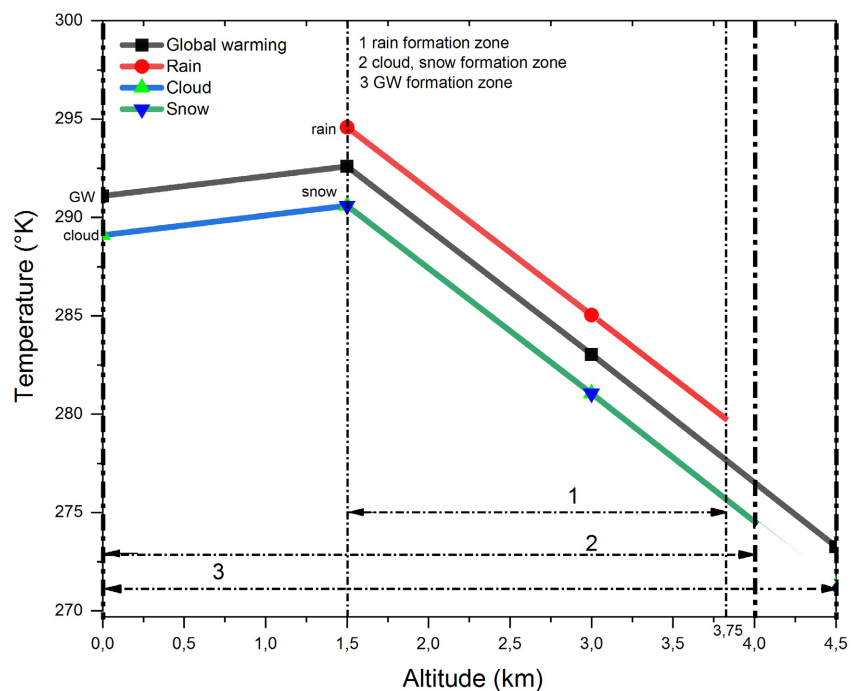


Figure 2. Special atmosphere of atmospheric phenomena.

Table 2 presents the constant values of atmospheric phenomena, calculated from numerical models. The units of measurement for these values are in Kelvin (°K) for global warming, rain, clouds, and snow; in kilometers per second (Km/s) for lightning; in meters per second (Km/h) for winds and evaporation; and finally, in gigajoules (GJ) for the discharge energy of lightning.

Among climatic phenomena, winds occupy a prominent place that warrants in-depth study. **Figure 3** presents the variations of winds in the Earth’s atmosphere. The study of their formation shows significant variability related to atmospheric

pressure at altitude and at the surface. According to this pressure, two types of winds are identified: altitude winds and surface winds. For altitude winds, the constant estimated at 4000 meters altitude is 3.997 Km/h, showing a type called a light breeze. This constant evolves according to atmospheric pressure down to 0 meters above sea level at 101.325 kPa pressure, with an estimated value of 5.43 Km/h. At altitudes, winds are generally low-speed above 1500 meters from the ground. For surface winds, they are responsible for the formation of real winds and related climatic disasters such as storms and cyclones. They are formed by an imbalance that generates an acceleration of air particles directed from higher pressures (depression phenomenon) to lower pressures. The wind interval involved in the phenomenon ranges from 3.997 to 5.43 Km/h for altitude winds and 5.43 to more than 30 Km/h for surface winds. Winds blowing at 30 Km/h are already classified as a climatic disaster and cause significant damage (Figure 3).

Table 2. Formation constants of atmospheric phenomena.

Phenomenon	Flash (Km/s)	Lightning (GJ)	GW (°K)	Wind (Km/h)	Evaporation (Km/h)	Rain (°K)	Cloud (°K)	Snow (°K)
Constants	275.16	3.9927	276.15	3.9927	2.9963	278.15	274.159	274.163
Altitude (Km) Min.-Max.	0 - 4	0 - 4	0 - 4.5	0 - 4	0 - 4	1.5 - 3.75	0 - 4	1.5 - 4

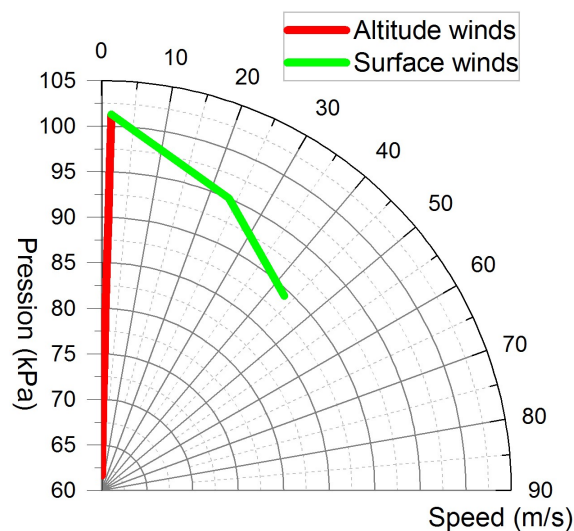


Figure 3. Variation of wind speed at altitude and surface related to atmospheric pressure.

The atmospheric phenomenon related to the formation of clouds, snow, and rain is caused by variations in atmospheric temperatures. Figures 4-5 present the process of these phenomena at two levels, namely the level of abundant precipitable water and the level causing very abundant (diluvian) precipitation. Thus, Figure 4 shows the precipitable water (PW) phenomenon in the form of atmospheric temperature, and Figure 5 presents the formation of the precipitable water

thickness in the atmosphere. For the case of abundant precipitation, the formation temperature of precipitable water is from 274.159 to 275.16°K for clouds; 274.16 to 278.19 for snow; and 278.15 to 281.15°K for rain. The thickness of precipitable water for abundant formation is from 59.36 to 60.72 mm for clouds; 59.18 to 65.7 mm for snow; and 65 to 71.85 mm for rain. As for very abundant precipitation, they are formed under atmospheric temperatures ranging from 275.16 to 291.6°K for clouds; 278.19 to 294.6°K for snow; and 281.15 to 298°K for rain, with precipitable water thicknesses from 60.72 to 99.32 mm for clouds; 65.7 to 111 mm for snow; and 71.85 to 125.43 mm for rain. Abundant water precipitations are considered normal climatic events because they do not cause damage, while very abundant ones are considered climatic disasters related to precipitation, causing significant damage and flooding on the Earth's surface. PW is the mass of water vapor contained in an atmospheric layer. PW values that are too low (0 - 58 mm or 0 - 5.8 g/cm²) indicate drought and atmospheric humidity, those between 58 and 72 mm or 5.8 - 7.2 g/cm² indicate significant precipitation (rain or snow), and very high PW values (72 - 125 mm or 7.2 - 12.5 g/cm²) indicate very significant, potentially catastrophic rain and snow precipitation.

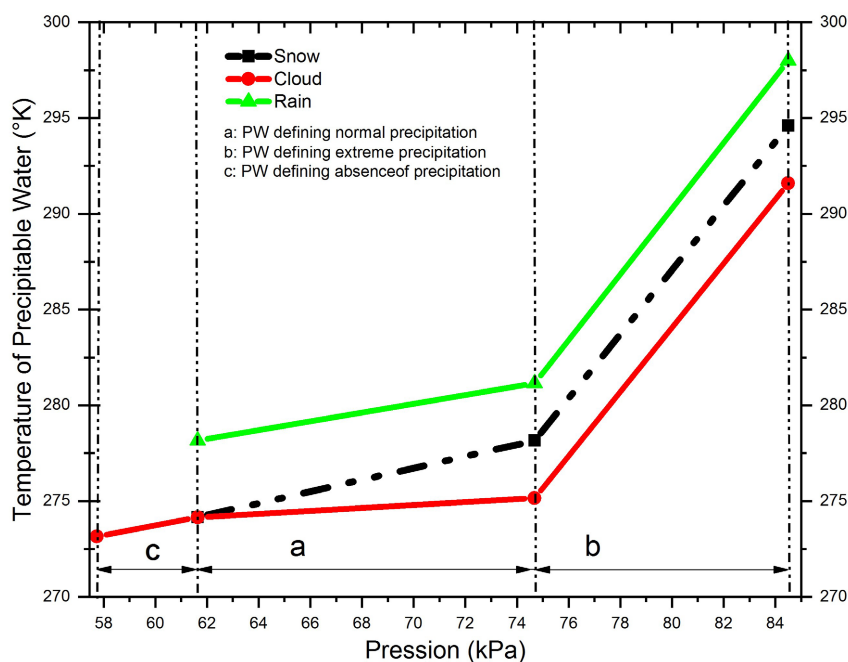


Figure 4. Variation of atmospheric temperature related to the formation of clouds, rain, and snow.

The phenomenon of global warming is associated with three atmospheric parameters: gas, humidity, and heat. Indeed, heat from solar radiation warms in contact with humidity and gas at 4000 meters altitude and evolves following atmospheric pressure to the Earth's surface. At 4500 meters altitude, the constant of incoming heat is 0.9963 J and it warms in contact with other atmospheric parameters, releasing a temperature of nearly 280.48 °K (3.01°C at 4000 meters altitude). This

warming heat amplifies according to atmospheric pressure down to the Earth's surface. **Figure 6** shows two curves, representing minimal normal global warming with a temperature of 294.45 °K or 21.30 °C (estimated at 1500 meters altitude, red curve) and maximal global warming (black curve) with a temperature of 326.28 °K or 53.45 °C estimated at 0 meters altitude. In the case of minimal global warming, areas close to sea level receive less temperature than distant areas. For maximal global warming, the warmest areas are aquatic areas (0 meters above sea level) and regions close to high pressure (101,325 Pa). Furthermore, the effects of global warming can reach up to 4500 meters altitude and even distant areas from the Earth's hottest spot, due to the combustion of surface atmospheric gases and the upward drainage of surface winds from high-pressure areas to low-pressure areas (**Figure 3**). The more global warming grows, the more areas near 0 meters altitude will become uninhabitable. In **Table 3**, comparing temperatures (normal and maximal global warming) shows that planetary warming is a reality and the values from the data are very alarming, due to the increase in certain gas components that ignite it.

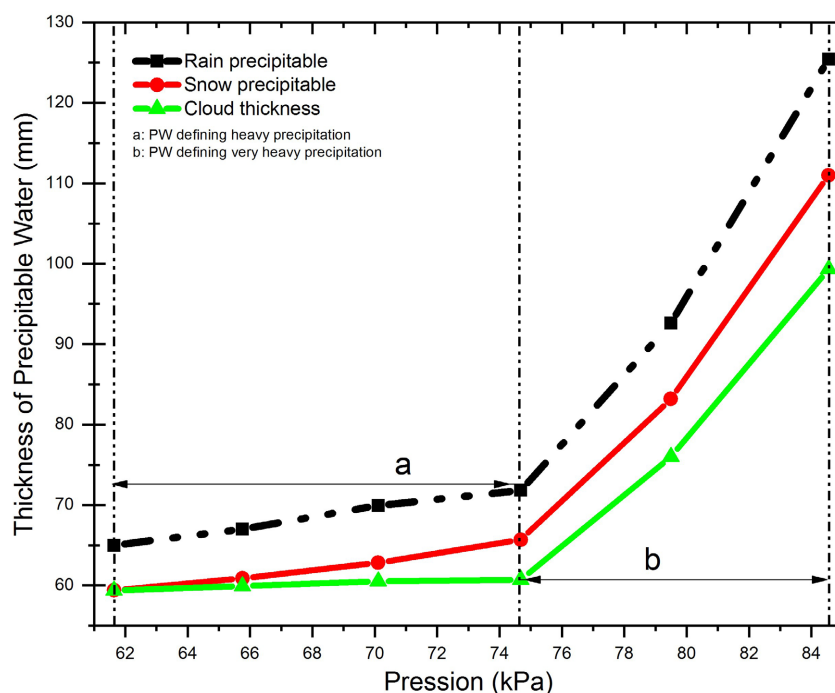


Figure 5. Variation of PW related to the formation of clouds, rain, and snow.

The atmospheric phenomenon related to surface water evaporation is caused by variations in atmospheric heat on one hand and global warming on the other. **Figure 6** presents the curves of water evaporation evolution, which evolves according to atmospheric heat and is distributed according to minimal and maximal planetary warming. Thus, on the curves, terrestrial heat remains constant according to the surface evaporation phenomenon. However, according to minimal or maximal global warming temperature, the rate of evaporated water evolves significantly. Indeed, the black curve shows a less significant variation following the

heat with an evaporation rate of 4.5 Km/h at 1.75 J for minimal warming and a rate of 54.18% compared to the constant 2.99 Km/h. On the other hand, following maximal global warming, the red curve shows an acceleration compared to normal with a peak of 6.5 m/s at 1.75 J and a rate of 118.60% compared to the evaporation constant (2.99 Km/h). The rate of water evaporation due to climate change (minimal and maximal global warming) is 62.42% (Figure 7).

Table 3. Atmospheric temperature values related to global warming before and during the industrial era.

Altitude (m)	Temperature (°C)		Pression (kPa)
	Minimal global warming	Maximum global warming	
4500	-0.07	-0.07	57.73
4000	3.01	7.47	61.54
3000	5.85	16.7	70.11
2500	7.18	21.45	74.68
2000	14.39	29.51	79.49
1500	21.30	37.72	84.55
1000	21.01	42.61	89.87
800	21.17	44.79	92.07
600	21.01	46.65	94.31
400	20.87	48.96	96.6
200	20.75	51.12	98.94
0	20.75	53.45	101.32

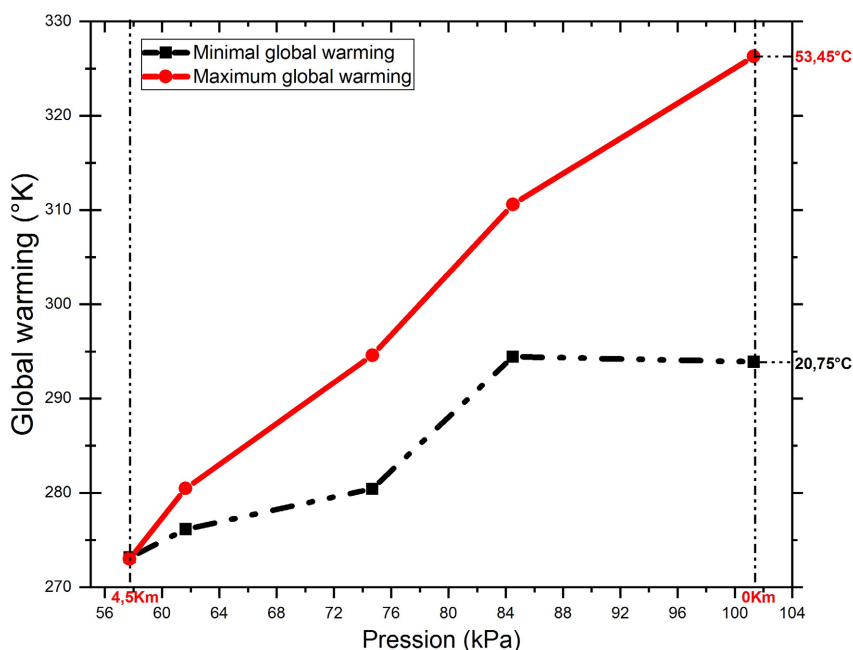


Figure 6. Variation of global warming related to climate change (before and during the industrial era).

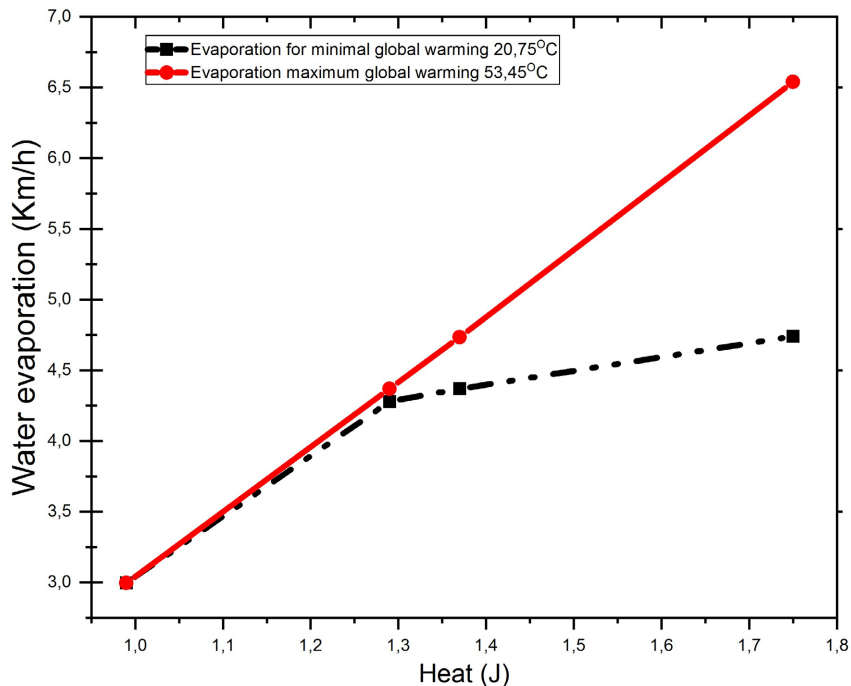


Figure 7. Variation of water evaporation related to heat and global warming of the planet.

According to our study, global warming causes direct effects such as increased temperature on the Earth’s surface and oceans, glacier melting up to 4500 meters, increased surface water evaporation, increased drought, increased wind severity, and increased hydrological phenomena related to rain, snow, and hail precipitation. Like the phenomena, disasters are not permanent factors evolving on the terrestrial and atmospheric space (Table 4). They are just generated by the atmosphere according to: predefined cycles, variations related to atmospheric pressure, global warming, and unexplained natural conditions. The only permanent factors evolving with altitude are atmospheric parameters such as dryness, fire, heat, air, humidity, water, cold, and ice.

The process of atmospheric phenomena follows one another in the formation of medium, significant, and very significant climatic storms on planet Earth. First,

Table 4. Direct effects of climate change on earth’s climate.

Climate change		
Atmospheric phenomena	Direct effects	Targets
Global warming	-Rise in temperature : maximum temperature of the planet estimated at 53.45°C <i>i.e.</i> 61.18% increase compared to the minimum estimated at 20.75°C before era industrialisation; -Melting of glaciers at a maximum height of 4500 m; -Forest fires.	-Ocean, near oceans; -Polar regions, Mountainous; -Tropics, Near equator.

Continued

Evaporation	<p>Increase in the evaporation constant of surface water (oceans, rivers, dams, etc.):</p> <ul style="list-style-type: none"> -Compared to the constant (2.9963 Km/h), the rate of evaporation due to minimal global warming is estimated at 54.18% <i>i.e.</i> 4.55 m/s speed at 1.75 J; -Compared to the constant (2.9963 Km/h), we estimate 118.60% evaporation rate due to warming maximum of planet with 6.55 Km/h speed at 1.75 J. -Rate of increase linked to climate change makes 64.42%. 	<ul style="list-style-type: none"> -Oceans, dams and surface waters -Forests -Human, animal and plant population
Hydrological phenomena (clouds, snow and rain)	<ul style="list-style-type: none"> -Increased cloud formation with a PW minimum 60.72 - 99.32 mm against 58.21 - 60.72 mm for a maximal; -Increase in snow precipitation with a maximum PW of 65.7 - 111 mm <i>i.e.</i> a rate of 68.95% compared to 58.21 - 65.7 mm, the minimum constant, <i>i.e.</i> a rate of 12.87%. -Rate of increase in snow precipitation linked to climate change is 57.08%; -Increased rainfall with a maximum PW of 71.85 - 125 mm and a rate of 73.97% against a minimum constant of 65 - 71.85 mm <i>i.e.</i> a rate of 10.54%. -Rate of increase in rainy precipitation linked to climate change is 63.43%; -Increase in drought due to lack of precipitation with a PW between 0 - 58.21 mm considered atmospheric humidity. 	<ul style="list-style-type: none"> -Polar regions, Mountainous regions, polar circle -Equator, Near equator -Tropics
Wind phenomenon	<p>Very frequent stimulation of violent winds by thermal conduction (exchange of hot and cold).</p>	

a process related to global warming leads to water evaporation and wind formation. A second process related to evaporation allows cloud nucleation in the cold regions of the Earth and triggers other processes such as lightning and thunder to initiate rain and snow precipitation. Finally, a last process related to winds allows the movement of clouds and heat in climatic regions. Also, the process of global warming, clouds, snow, and rain is linked to the triple point of atmospheric temperature. Moreover, atmospheric pressure is one of the factors associated with the variability and mobility of the studied phenomena, setting the minimum and maximum height within their formation framework (Table 2).

5. Conclusion

Since the industrial era, Earth's climate has increasingly experienced extreme weather conditions due to climate change. Extreme and violent atmospheric

phenomena are recorded globally, with global warming, according to our study, having already reached almost the maximum at 53.45°C, very abundant rain and snow precipitations with a maximum PW of 125 and 111 mm (12.5 and 11.1 g/cm² of water), surface water evaporation fluxes above normal at a speed of 6.55 Km/h, increasingly violent winds with speeds far above 5.43 Km/k, and catastrophic climatic effects. The concern following the results of this research foresees a climatic boom for humanity, linked to the excess of global warming by a rate of 61.18% compared to normal (20.75°C) and a water evaporation increase rate of 64.42%. Given these alarming data on the effects of climate change, the question of human involvement remains, posed around two key hypotheses: hypothesis 1, if global warming is linked to human impact on nature through gas emissions, then our planet will undoubtedly face an imminent climatic catastrophe due to the increase of this atmospheric parameter (gas); hypothesis 2, if GW is a normal cyclical phenomenon, then the planet will experience climatic attenuation once the limit is reached. Therefore, process by process, atmospheric phenomena associated with climatic storms are natural origins allowing planetary climate cycles. This study remains an approach to the impact of current climate change, but not on the human condition in response to it, which could interest other researchers in the same field.

Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

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