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Disasters and climatic phenomena today and in the past

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ABSTRACT

The current interest and frenzy discussion and attribution of all the evils in climate change, the climate crisis, has led to skepticism about its right research direction, as well as its management and priority implementation actions, extended to its impacted effects on humans, the environment, and the economy. Rather than being the result of a simple mistake, an adequate dispute is based on diversity. I argue that many aspects of the scientific and ethical debate on climate change can be usefully viewed from a different more human-environment-centered perspective. This opinion article presents the topic recalling the historical past and discussing the current opinions and policy orientations followed by scientists, and decision-making centers. Emphasis is given to the prioritized sectors for mitigating the currently undesirable effects, in parallel to re-orientation and breakdown of research on the contemporary causes of climatic change from the non-human interventions.

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The past geo- and archeo-archive

The geological events that cause short-term catastrophes, particularly in coastal and fluvial areas and their impact on human settlements and lives in historic and prehistoric times must be regarded as witnessed facts. It is crucial to objectively assess the intensity and effects of these events and subsequent disasters based on human records.

Catastrophic events such as floods, global warming, earthquakes, fires, volcanic eruptions, and tsunamis led to the collapse of ancient civilizations, especially those that contributed to the birth of myths and legends, and are the subject of long-term intense debate. There are several accounts of the connection between legendary deluges[1] and natural disasters; in addition to moral and religious questions, natural phenomena also exist beyond myth. Indeed, natural phenomena (terrestrial

[1] Plato mentions three ''disastrous floods which preceded the destructive deluge of Deucalion'' (Critias, 112a). In another dialogue, Plato attributes extensive wildfires to heavenly powers when he refers to Solon's visit to Egypt (Timaeus, 22c-d. cf. Plato, Timaeus-Critias, in Jowett, 1892). In the same dialogue, Plato describes the much-discussed Atlantis, as described by Egyptians to Solon, which was ruined 9000 years before his time. The well-known Chinese legend tells of Yu, who in 2100 BC battled against the Yellow River flood. Due to the country's vast river system and lowland terrain, a large portion of the eastern, most populous, fertile, and economically significant regions are vulnerable to flooding (Pang, 1987; Liritzis *et* al., 2019; Westra *et al*., 2022).

or solar origin) may affect climate[2]. For example, large-scale volcanic eruptions release ash and gasses into the stratosphere, where they reflect solar radiation and cause scenarios that have been related to a few-year drop in global average temperature. Some scientists, however, assert that there may be a connection between this volcanic activity and warmer winter temperatures in northern Europe (Mitchell, 1970; Andreae, 1996; Ledley *et al*., 1999; Hansen *et al*., 2000; Singer, 2001; Singer *et al*., 2007; Stitch *et al*., 2007; Skinner, 2012; Six *et al*., 2013).

Encountered instances of devastation throughout the *circum Mediterranei Maris Orientalis* area, seemingly in coastal locations, as shown by archaeological remains and mythical narratives have been interpreted through the lens of geomythology (Liritzis *et al*., 2019). Long-term, more or less successive, geological processes and climatic fluctuations have a more pronounced effect on human history.

There have been several prominent examples referring to mythological floods and their connection to natural disasters

Historical accounts provide repetitive descriptions of cultural development. Geo-archives (*i.e.*, evidence from geology, sedimentology, and geomorphology) and the human record (*i.e.*, archeology and history) are considered records - evidence of events in the past (Wu *et al*., 2019).

Astronomical causes have introduced severe phenomena (warming, heavy rainfall, monsoons, droughts) imposed on ancient societies, including catastrophic meteor impacts. Terrestrial rearrangements and astronomical effects introduced a non-linear nature (irregular fluctuations with sporadic periodic occurrences of the same phenomena) into the transformation of human cultural evolution and the reshaping of the earth's surface (Clube and Napier, 1982; Liritzis, 2013).

The transitory nature of geological, geophysical, and indirect (proxy) climate indicators, as well as astronomical phenomena within the solar system, present a wide range of semi-periodic frequencies (recurring phenomena) as variable and active environmental factors, which, together with anthropogenic factors, reshape the human context. Several conspicuous examples have been reported on mythological deluges and their relation to natural catastrophes. Coastlines and human settlements have been significantly impacted by the sea level rise and extreme climate events. Alluvial[3] sediments, sedimentary deposits, and land surface modifications have drastic effects on ancient settlements. The images of deluges, floods, and falling skies were committed to memory. Scientific approaches have been used to objectively evaluate global disaster instances, which included the Great Flood of Gun-Yu in China, as well as those from South America, Mesopotamia, the Middle East, and the Mediterranean coast.

Natural and anthropogenic factors cause an increase in temperature

The Anthropocene[4] sea level is rising, and climatic events have had a decisive and prominent role on the coasts and human settlements. These phenomena were recorded in the memory of the people as floods, cataclysms, and as miracles from heaven. Global examples of disasters originating from the coastal Mediterranean, the great flood of Gun-Yu in China, and those from South America, Mesopotamia and the Middle East and others, were critically evaluated with a scientific perspective and scientific methods (Liritzis *et al*., 2019; Westra *et al*., 2022).

The current heat waves give us the impetus to review the past from a scientific point of view. Notwithstanding the human-driven extreme short-term climate change cause, as ascertained from records, the natural causes (beyond the well-known long-term variation, but the sudden jerks), are still much less funded research. Over the past tens of thousands of years, humanity and our planet have experienced extremely extreme climatic events over long periods. Scientists have identified these ages as glacial and interglacial. The Earth and humanity have experienced cold periods (referred to as "ice ages" or "glacials") and warm periods ("interglacials") in roughly 100,000-year cycles for at least the last 1 million years. The last of these Ice Age glaciers peaked about 20,000 years ago (Rapp, 2019). Hence, the current period we are going through is the interglacial and it started about 12,000 years ago. Within each such climatic period there are temperature fluctuations to such an extent that the medieval period is called the Little Ice Age (LIA), a climatic interval that occurred from the early 14th century to the mid-19th century, when the mountain glaciers expanded in various locations, including the European Alps, New Zealand, Alaska and the southern Andes, and mean annual temperatures across the Northern Hemisphere decreased by 0.6°C relative to the mean between 1,000 and 2,000 AD. Thus, the geological record reveals that Earth's climate has been changing for as long as our planet, with natural cold and warm phases. The Little Ice Age didn't end until 1850. It's no surprise that we're now experiencing a warming period. Similar meteorological phenomena (but also other natural agents), accompanied by extremely sudden high intensity

[2] https://www.nrdc.org/stories/what-are-causes-climate-change#natural

[3] Alluvium: loose clay, silt, sand, or gravel that has been deposited by running water in a stream bed, on a floodplain by river action.

[4] Anthropocene: is an unofficial unit of geologic time, used to describe the most recent period in Earth's history when human activity began to have a significant impact on the planet's climate and ecosystems. Scientists are divided on when it begins. Others date to the agricultural revolution to around 10,000 BC. In 2016, the Anthropocene Working Group concurred that the Anthropocene epoch is distinguishable from the Holocene and commenced during the year 1950 when the Great Industrial Revolution was launched, promoting a momentous growth in human activity that continues to impact the planet. The concept of the Anthropocene is founded upon the presupposition that, owing to the consequences of amplified populace and economic progression on the global environment, mankind ought to be classified as a principal geological and geobiological factor on Earth. Along with other scientists, Nobel Laureate Paul Crutzen, a member of EASA and the term's originator, argued that human-induced alterations to the Earth's system were so profound and long-lasting that a new epoch could be declared in its history. Furthermore, the Anthropocene concept advocates for a novel, comprehensive approach to understanding the influence of humans on natural systems. (https://www.environmentandsociety.org/tools/keywords/paul-crutzen-popularizes-concept-anthropocene).

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lasting in hours, and infrequently within a century, are found in the recent historical record.

The so-called Holocene Climate Optimum thermal event in the current interglacial period (8,000-4,000 BC) consisted of increases of up to 4°C near the North Pole (Marcott *et al*., 2013). In one study, winter warming was 3 to 9°C, and in summer 2 to 6°C in north-central Siberia (Maslennikova *et al*., 2016; Koshkarova and Koshkarov, 2004). Northwest Europe experienced warming, but there was cooling in Southern Europe. The average global temperature during this 200-year peak period (around 6,500 BC) was about 0.7°C higher than the average temperature of the 19th century AD, just before the Industrial Revolution, and 0.3°C cooler than the average of the period 2011-2019 (Kaufman *et al*., 2020). This mid-late Holocene period witnessed the rapid development of Neolithic and Bronze cultures, and during this pivotal period, when human mobility increased, human populations grew and civilizations developed at an unprecedented speed, the climate also changed significantly (Fagan and Scarre, 2016; Mayewski *et al*., 2004; Lazaridis *et al*., 2022; Liritzis, 2022; Cline, 2014).

The Eemian Ice Age[5], which occurred between 130,000 and 115,000 years ago, was far warmer than previously believed, according to the scientific findings. It warmed up by 8°C compared to today.

Extreme temperatures in relatively short periods were and will remain natural phenomena that still seek a scientific explanation, let alone a prognosis. Short-term estimates are made but with uncertainties. The climate system is complex and non-linear, temperature fluctuations are not predicted, as wished, since the models are based on a very minimal studied period.

The (unpredictable) extreme climate phenomena could be the result of many internal (core, mantle, crust) factors of the planet Earth, its movements (rotations, precession), solar radiation and solar wind, the current atmospheric composition, the gravitational forces in the solar system and the cosmic journey of the planet in our galaxy (Xanthakis *et al*., 1995; Liritzis, 1993).

Today's climate change is not unprecedented in the history of our planet and the civilizations it has hosted, but it is unprecedented in today's inhabitants. In every anthropogenic or natural action in the environment as a natural consequence, there is feedback from nature itself (crust - Earth's surface and atmosphere). Everything is transformed into a continuous dynamic becoming. The evolution of living beings and inanimate objects follows the Heraclitus quote. "*everything flows and nothing stands still*," within an eternal fire.

Climate science needs to be less 'politicized', while climate policies need to be more scientific

Briefly on climate change and politics

Climate science needs to be less 'politicized', while climate policies need to be more scientific. Preventive actions to protect the environment should be globally agreed upon at the level of the scientific community and propagated as mitigative actions at the political level of specific countries for progressive implementation. Scientists must openly face the uncertainties and exaggerations in their predictions of global warming, while politicians must calmly face the real costs and imagined benefits of their policy measures. We should be cautious and skeptical in relying on climate models which are necessary efforts (Long, 2011), but the lack of adequate proxies or direct measurements of climate elements from the past makes the models debatable. The disagreement and irreconcilable positions among researchers could make them flawed and unreliable as policy tools, and only a very short-term tendency may seem statistically sound (see Hansen *versus* Mann disagreement: Hansen *et al*., 2023; Mann and Kump, 2015). However, by a large majority, climate scientists agree that the average global temperature today is warmer than in pre-industrial times and that human activity is the most significant factor[6] (Oreskes 2018). This does not mean that the investigation should be untightened, but the funding should be distributed rationally between research in climate models and quick decisions, and the protection projects for the reduction of catastrophic consequences. Considerable concerns center on past shortcomings of specific - but non-generalizable - failures of unique regional models (Lloyd *et al*., 2021). I could say that reasonable disagreement is a way of analyzing such contestation. One may call for a plea of patience in the solving of different research questions and specifically failures, as well as to enhance knowledge, discourse, comprehension, and communication on the philosophy of climate research and added value in climate modeling.

We urge for considering the issue as a multiparametric complex where the physical basis involves more research on terrestrial and astronomical interrelated phenomena (principle of causation of all associated interrelated phenomena). Under the global warming equilibrium sensitivity, either from atmospheric carbon dioxide doubling (Bjordal *et al*., 2020) or other causes, more analyses should be re-directed on the risk of domino effects being triggered by each of the individual "tipping elements"[7] and other indices. For example: astronomical indices (solar, interplanetary, gravitational) and terrestrial indices (proxy atmospheric from ice cores, growth rates in tree

[5] The Eemian (also called the last interglacial, or interglacial), was the interglacial period that began about 130,000 years ago and ended about 115,000 years ago.

[6] https://www.nationalacademies.org/topics/climate

[7] Tipping points are thresholds where a tiny change could push a system into a completely new state (https://www.carbonbrief.org/explainer-nine-tipping-points-that-could-be-triggered-by-climate-change/)

rings, species composition of sub-fossil pollen in lake sediment or foraminifera in ocean sediments, temperature profiles of boreholes, and stable isotopes and mineralogy of corals and carbonate speleothems to mention the major ones) (Liritzis and Petropoulos, 1986; Liritzis and Kosmatos, 1995; Liritzis and Galloway, 1995; Liritzis *et al*., 1994, 1995; Liritzis and Grigori 1998; Petropoulos and Liritzis, 1984).

Climate attribution science today studies whether or not a disastrous occurrence becomes more likely due to climate change such as global warming. The latter enhanced by the greenhouse effect, has been causing extreme weather events. My opinion is to understand their intensities, mitigate their resilience, and manage the impacts by taking measures of protection that withstand extreme flooding, heat, drought hurricanes, tropical cyclones, etc, events[8]. We must leverage current solutions and all of our inventiveness, much as we did with the creation of numerous vaccinations in response to the pandemic. Certainly, today Climate models based on short and long-term, direct, and proxy data, are used to understand the causes of climate change and provide a glimpse of the changes in the future[9]. This is an ongoing development where sharing data in a cooperative spirit is most necessary since this is a global phenomenon and affects us all.

We urge for considering the climate change issue as a multiparametric complex where the physical basis involves more research on terrestrial and astronomical interrelated phenomena (principle of causation)

The post-event review capability PERC project by Zurich Insurance Group Ltd.[10] has produced evidence that these disastrous events contained a climate change signal.

To deal with the greenhouse phenomenon (produced either by natural causes[11] or gas emissions[9] and increase climate resilience. Yet, the most decisive is to understand their intensities and take protection measures. Instead of only limiting carbon dioxide (CO_2), we should also recognize that increased CO_2 is favorable for nature and agriculture.

There is growing evidence, though, that this steady rise in global temperatures coincidentally is impacting the number, frequency, and duration of natural hazards. Hence, climate policy must respect scientific and economic realities and focus on minimizing potential climate damage through adaptation based on proven and affordable technologies. It should invest in new technologies and alternative models of safety and protection, and strengthen agriculture, food (a hunger-free world remains a huge challenge), health, and energy efficiency pledges (see COP28 below). Moreover, remember, that water vapor, deriving from different causes, is Earth's most abundant greenhouse gas. It is responsible for about half of Earth's greenhouse effect[12].

An activity that appears to have an unfavorable consequence creates feedback in the earth's system (surface-atmosphere) that promotes other positive outcomes for life and the environment. This is accomplished by the interactions, linkages, and propagation of a triggering force of some system components throughout the environmental network system. The reaction/feedback to a natural or anthropogenic activity unfolds and changes into nature's dynamic complexity.

Rising global temperatures are thawing the frozen ground of the Arctic, also known as permafrost (permanently frozen ground) in the Northern Hemisphere. This process releases carbon dioxide that has been stored in it for thousands of years. The estimated amount of carbon stored in the permafrost is four times greater than the total CO_2 emitted by modern humans. Carbon dioxide's lifetime cannot be represented with a single value because the gas is not destroyed over time, but instead moves among different parts of the ocean–atmosphere–land system. There is statistical evidence that global warming is intensifying hurricanes, floods, droughts, and other similar natural disasters of increasing frequency. In the past, there was no evidence yet of an increase in terrifying natural events, but sporadically occurred. However, there is ample evidence that measures, on a general scale, to limit CO_2 are as harmful as they are costly[13]. Certainly, carbon dioxide and chemical toxic gas emissions have a self-accepted effect on the health of the residents of an industrial area. All actions capable of protecting the health of the residents have to be adequately considered by the scientific board and progressively propagated. Protection of the environment as well as protection of the residents are so very important and have to be cumulated in the same protection target.

The Intergovernmental Panel on Climate Change (IPCC) (https://www.ipcc.ch/about/), the United Nations body for assessing the science related to climate change, with its 3 Working Groups produces all-encompassing Assessment Reports regarding the scientific, technical, and socio-economic status of climate change, its effects, potential future hazards, and feasible measures for mitigating the pace of global warming.

A group of 1609 university professors from around the world this August[14] strongly oppose the zero CO_2 policy proposed for 2050, as they consider it harmful and unrealistic. Instead of mitigation, they advise Europe to focus on adaptation, as this approach is effective, regardless of the underlying causes of climate change.

[8] https://royalsociety.org/topics-policy/projects/climate-change-evidence-causes/question-13/

[9] https://earthobservatory.nasa.gov/features/RisingCost/rising_cost5.php; https://www.bgs.ac.uk/discovering-geology/climate-change/how-does-the-greenhouse-effect-work/

[10] https://www.zurich.com/en

[11] Natural influences on the climate include volcanic eruptions, changes in the orbit of the Earth, and shifts in the Earth's crust (known as plate tectonics), Earth's orbit around the galaxy.

[12] https://climate.nasa.gov/explore/ask-nasa-climate/3143/steamy-relationships-how-atmospheric-water-vapor-amplifies-earths-greenhouse-effect/

[13] https://www.ox.ac.uk/news/2023-01-19-co2-removal-essential-along-emissions-cuts-limit-global-warming-report; https://www.1pointfive.com/about

[14] Global Climate Declaration August 14, 2023. Global Climate Intelligence Group. The World Climate Declaration was initiated in 2019 by emeritus professor Guus Berkhout, founder of the Dutch Climate Intelligence Foundation (CLINTEL). The list of signatories is a living document that is regularly updated with new additions. The most up-to-date version can be found on www.clintel.org

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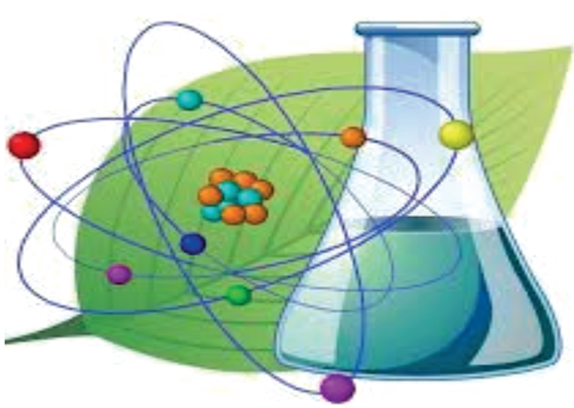
Science and technology should develop ways with immediate implementation to deal with climatic disasters; solve problems arising from these and prevent fatal consequences in the present and in the near future

Their recommendation to European leaders is that the scientific community should work towards a more comprehensive understanding of the climate, for better results.

It is worth noting that at the recent COP28 in UAE[15], amongst 9 projects, the most attractive and beneficial projects for countries and their needs, to pledge, concerned the climate impact to fund resilience and mitigation measures. For agriculture, food, health, and energy efficiency (130-147 pledges), in contrast for finance (13 countries pledges, the minimal), for hydrogen (37 countries), and 60-75 countries for the rest, *i.e.*, for peace and relief recovery (76), gender responsive-just transitions (76), cooling (66), multilevel partnership (65).

In our opinion, the $83,7 billion committed for the actions of climate finance, and any funding at the climatic risk, should become interlinked to essential present wider research directions, and longer-term risks humanity faces. Policymakers should come along with immediate development and protection works and implementation actions.



[15] https://www.cop28.com/

From our historical record and prehistoric assessment of climate changes, science and technology should aim for a better World. Paleoclimate research is critical for comprehending the effects of present and future climate change because it gives essential knowledge into previous climate conditions and how ecosystems respond to environmental variations. Paleoclimate archives can act as "guardians" for predicting future climate change by reconstructing the physical and biological conditions of the past. This knowledge can help guide climate change mitigation and adaptation decision-making and policy formulation. Furthermore, paleoclimate research improves our understanding of the Earth's climate sensitivity and our capacity to anticipate future change (Bradley, 2015; deMenocal, 2001; Song *et al*., 2021; Seltzer *et al*., 2022; Kaboth-Bahr, 2023).

Political decisions and interests that use science and technology must turn the funding to the most effective, protected manners of predictable behavior of the human and natural environment. They should undertake projects with emblematic dimensions to deal with every unpredictable weather phenomenon, pandemic, or any reckless and senseless destructive behavior of certain states and individuals. Such care enhances the peace, health, and happiness of social groups of all sizes and humanity as a whole. Political decisions should re-direct on an increased 'loss and damage fund' to help pay for the harm caused by mounting climate impacts. Not only relieving peoples' lives but also, to reiterate, making constructions and developing measures to limit the impact of future unavoidable extreme climatic events.

While politics should aim to minimize potential climate damage, it should prioritize adaptation strategies based on proven and affordable technologies and re-engineering instruments to minimize climate damage in economic, cultural, and human factors.

The climatic change is an integral phenomenon on Earth and with life on Earth and as such requires a holistic scientific approach; because mankind has suffered from it since its inception on the Earth, today's scientific and technological advancements must find solutions to deal with it. To solve problems arising from climate disasters and to prevent consequences in the future, instead of focusing on and considering carbon dioxide and zero carbon as the only problem.

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