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Hypothesis

The terrestrial metasystem

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Abstract: A speculative argument is presented which suggests the possible existence of a global metasystem that would be characterized as an emerging from the interaction of the units that make up the planetary system. The metasystem´s units would be the different physical, chemical and biological processes occurring in the subsystems that form the metasystem: magnetosphere, atmosphere, geosphere, hydrosphere, and biosphere. The revised global metasystem is broader than that considered in the Gaia theory or in Earth System Science, where the Earth's crust and upper atmosphere, i.e., the volume where the presence of life occurs, are considered as the limits of the system. The maintenance of the dynamic state of the global metasystem it is achieved by dissipating the free energy derived from the electromagnetic radiation of the Sun, the obtained from the Earth-Moon gravitational interaction and the energy resulting from the dynamics of the Earth core and mantle, which produces the magnetic field and much of tectonic activity. For the human species, the importance of a greater understanding of global metasystem is based on the fact that natural resources and the climate system are products of the subsystems of the global metasystem. It is possible therefore that human activities that modify the atmosphere, hydrosphere, and biosphere, change the dynamics of global metasystem.

Keywords: Emergence; Complex Adaptive Systems; Ecosystems; Biosphere; Gaia.

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1. Introduction

The human species exists immersed in what is known as the terrestrial system, which consists of a series of subsystems or phases known as the magnetosphere, atmosphere, geosphere, hydrosphere, and biosphere. The group includes physical, chemical and biological processes energized by the electromagnetic radiation of the Sun, by the Earth's magnetic field, by the gravitational forces of the Earth-Moon-Sun system and by the dynamics of the plates, the mantle, and the planetary core. This system, monumental in time, space, and complexity, is made up of a network of interactions between the components that define all the processes that maintain the system in a dynamic state outside equilibrium, characterized by a high rate of dissipation of free energy [1].

A consequence of the characteristics of the terrestrial system is that using the optics of systems theory, the existence of a "system of systems" or global metasystem at a level of description different from that of the manifest components of the terrestrial system is possible. The global metasystem would be the result of the interactions of the components of the magnetosphere, atmosphere, geosphere, hydrosphere and biosphere subsystems. The existence of this global metasystem is predictable as an emergent behavior derived, on the one hand, from the usual tendency of natural systems to diversify the components of the subsystems that dissipate free energy [1] and, on the other hand, to the hierarchized or nested natural structure of subsystems in systems, of these in supersystems, etc. which gives rise to the emergence of metasystems that group sets of systems forming entities of higher dimension and organizational scope than the systems from which they emerge [2].

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To briefly explain how this metasystem could be created, let us initially consider a system **R** of (*n* + *m*) aggregate components, but without interactions. The system can be described entirely from the average behavior of n and m (the system's microstates) in a time range (t_2-t_1). An example would be the description of an ideal gas. The complete behavior of the system **R** is calculable from a series of equations, for example, position, pressure, and temperature.

A very different situation would occur if, between the components of the system, which we will now call **S** to differentiate it from the previous one, interactions occur **S=(n+m)+(n*m)+(n*m*m)…[(n*m)*(n*m)]…[(n*m)*(n*n*m)…]**… in (t_2-t_1), then it is possible that the microstates of *n* and *m* give rise, thanks to the interaction and successive aggregation, as well as to the interaction of the aggregates themselves, to macrostates of the original system **S** with new emergent properties not predictable from the simple statistical description of the individual components.

The complete behavior of the system **S** is undeterminable in a practical sense (but without affirming that **S** is formally not computable [3]), since it would require a series of equations that include all the components and their possible properties, positions, interactions and aggregations in (t2-t1). The system **S**, thanks to the action of a control mechanism **C** that is one of the emergent properties of the system [4], can diversify into *k* $\mathbf{S_1}$**,** $\mathbf{S_2}$**,…,** $\mathbf{S_k}$ synergistic systems, or to associate with others systems **M**, **P**, **R**, etc., different from **S**, and form a metasystem **MS**, with at least one emergent property not present in the *n* systems $\mathbf{S_1}$**,** $\mathbf{S_2}$**,…,** $\mathbf{S_k}$ or **M**, **P**, **R**, etc., that make up **MS**.

In other words, **MS** is a metaprocess derived from the dynamic interaction of the original systems and shows one or more emergent properties. The new or new emergent properties are obtained from the interaction of the *n* systems. On the other hand, the dynamic behavior of the metasystem **MS** is in a different complexity scope (or complexity level) concerning the systems $\mathbf{S_1}$**,** $\mathbf{S_2}$**,…,** $\mathbf{S_k}$ or **M**, **P**, **R**, etc. [5].

For the topic that this manuscript deals with, it is proposed that the dynamic interaction of the magnetosphere, atmosphere, geosphere, hydrosphere and biosphere systems generate a global metasystem. As with other metasystems [2], the process of aggregation of subsystems and systems of the terrestrial metasystem occurs automatically, is guided (evolves) by one or more selective mechanisms, generally related to energy flows, matter or information. As in all-natural systems, it is possible that the goal that guides the evolution of the system is to maximize the production of entropy [6]. Therefore, the evolution of the metasystem would result from the imperative that the magnetosphere, atmosphere, geosphere, hydrosphere and biosphere components adjust the interactions so that the energy and matter flow lead to a state of maximum entropy production [1].

It is probable that the above global metasystem behaves as a qualitatively different entity, an epiphenomenon with emergent properties that could have an impact on the regulation of the planetary systems from which it arises. The emergent properties mentioned above result from the dynamic interactions of the components: magnetosphere, atmosphere, geosphere, hydrosphere, and biosphere.

It should be noted that the global metasystem is different (because it pertains to another description scope) of the hypothesized interactive homeostatic system whose units are the living beings and their physicochemical environment (as in the Gaia hypothesis developed by Lovelock [7], the organic Gaia presented by de Castro-Carranza [8], or the Gaia theory described by Lenton and van Oijen [9] and revised by Onori and Visconti [10]).

The global metasystem is not a superorganism in charge of the control of the conditions that favor life, nor would it be a entity with any knowledge or conscious interest in the existence of life or humans themselves. The proposal here described is that this global metasystem and its new properties would be an epiphenomenon that would encompass Gaia and would embrace the other components that have not been previously grouped with Gaia, that is, the core and the terrestrial mantle, as well as the magnetosphere. This conglomerate would use all available energy sources (gravitational of the Earth-Moon system, magnetic of the Earth's core, electromagnetic of the Sun and physicochemical of the atmosphere, hydrosphere, magnetosphere, and geosphere) to organize

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as a dynamic metastructure with evolution capacity, whose C control activities could impact all the S systems that comprise it, including the biosphere where the human species is placed.

Lenton and van Oijen [9], according to the criterion of the volume of space influenced by living organisms, drew limits to the Gaia system, placing it in the volume contained between the exosphere (at about 500 km high) and several kilometers under the crust, the extreme planetary boundaries where live microorganisms have been found. However, if the criterion of the processes that form and energize the global metasystem is met, then it must be included in the lower limit the whole planetary volume including the crust, the mantle and the nucleus, and in the upper one the magnetosphere.

It can be a subject of discussion if the complete Earth-Moon dynamic system should be considered as the volume of the global metasystem. However, in this manuscript it is not regarded that way since, although it is well demonstrated that the Moon exerts an effect on organisms and climate through its gravitational effect [11], the dynamics that cause the synodic effect results from the interaction of the masses of the Earth, the Moon and the Sun. Consequently, it could be considered an external source of energy and information such as electromagnetic radiation, solar wind and the gravitational field of the Sun. In other words, the Earth-Moon system is possibly part of a larger metasystem that would include the components of the solar system.

2. The biosphere and Gaia in the global metasystem

In the global metasystem, life is located in the system called the biosphere. Life is one more of the forms of organization of matter-energy-information that allows the dissipation of free energy and its transformation into entropy and information equivalents for the construction of new structures [12]. The goal of the process called life that occurs in the biosphere seems to be to spread and diversify in multiple ways to maximize the dissipation of free energy [6]. But life is only one of the processes in action: as the critical thing seems to be the effective consumption of free energy, the global metasystem does not seem to distinguish between biotic and abiotic systems [1].

In quantitative terms, the amount of free energy dissipated (or in other words, the amount of information used, and entropy produced) by the energy fluxes associated with the biosphere is very small compared with the energy transformations of the magnetosphere, geosphere, atmosphere, and hydrosphere [13].

It seems that by adhering exclusively to criteria merely of energy flows, the biosphere does not appear as the most significant component. Despite this, organized life in the form of a biosphere has lasted for more than 3.5x109 years, which seems to indicate that the process is valuable in the context of the functioning of the metasystem beyond the flow of energy dissipated at a specific moment. The following reasons could explain the transcendence of the life phenomenon in terms of the evolution of the global metasystem:

a. For the capacity of life to generate new channels of use and dissipation of free energy.
b. By creating new properties such as metabolism, evolutionary plasticity, consciousness, and intelligence, which increase the ability of the system to adapt to changes and to develop different futures.
c. For the ability to modify extensively, on geological time scales, the properties of other systems, in particular, the atmosphere, the hydrosphere and the geosphere.

If the presence of a biosphere does not occur (which is not equivalent to saying that there is no presence of life), as happens in nearby Mars and Venus, the global metasystem would not be able to develop processes that modify planetary evolution beyond what it is achieved with the action of the abiotic processes of free energy dissipation. In that sense, the global entropy production of the Earth has been estimated to be higher than the neighboring Mars and Venus [14], and this occurs thanks to a complex of interactions between the components of the global metasystem that resulted from the changes triggered by living beings in planetary evolution.

In the biosphere, living organisms exhibit interactions between the organisms themselves and between these and the physicochemical components of the terrestrial system. The different units of the system form local aggregates that could be equivalent to what we call ecosystems, which in turn show interactions with other aggregates building biomes. These biomes, in turn, interact with each other and with other components in different levels of description [15,16]. The whole set of interactions and successive aggregates forms the biosphere which is one of the Sk systems of the global metasystem **MS**.

On the other hand, the biosphere, the atmosphere, the hydrosphere and the crust of the geosphere form what is called Gaia in the framework of the homonymous theory ([7–9,17]. Those four systems $\mathbf{S_1}$, $\mathbf{S_2}$, $\mathbf{S_3}$ and $\mathbf{S_4}$ grouped in Gaia, in turn, would be part of the global metasystem **MS**. Other names that have been given to the planetary conglomerate are Gaia, Global Biosphere [18], Common of Common [19], Supersystem [10] or Mother Earth [20].

Although it can receive different names and its existence has been contemplated for a long time in various schools of explanation of the world, generally the description of Gaia, Mother Earth or Global Biosphere is done placing them in the complexity scope where prevails the human consciousness and experience, that is, from the cells to the ecosystems [21] or at the level of the biomes, apparently assuming that one would not expect something further because it is not ostensible [22].

In the proposal presented here of global metasystem, the resulting **MS** entity and its new emergent properties would be in a complexity scope different from that of human evolution, history, and consciousness. Considering only the energy context of the system, the purpose of the organic life of the biosphere would possibly be to function as a tool or additional mechanism for the use of information and production of entropy, within the set of other systems: hydrosphere, geosphere, etc., that make up the global metasystem.

3. The global metasystem as an adaptive complex system (CAS)

Complex adaptive systems (CAS) are dissipative dynamic systems that present characteristics of continuous adaptability, hierarchical organization, and source of constant innovation [9]. CAS are systems that evolve over time and hence the importance of considering this point for the global metasystem. If this is a CAS, it then leads to questions such as, what will be the adaptive changes that it will present in the future? Can these adjustments in the global metasystem impact the human species?

To verify the possibility that the global metasystem is a complex adaptive system (CAS), we start from Levin [18] who defined three minimum properties for a CAS: (i) individuality of the components; (ii) localized interactions between the components; (iii) an autonomous process that selects between the components. These three properties are exhibited by cells, organisms, ecosystems, by the biosphere and by Gaia [8,9], and it seems that also by the global metasystem.

The individuality of the components and the localized interactions are evident and demonstrable for the components of the global metasystem. Regarding the autonomous process that makes selection among the components, it depends on the complexity scope considered: for cells, organisms, ecosystems and the biosphere would be the principle of maximum energy flow derived from the creation of biological complexity and biodiversity [6,23] in a framework controlled by natural selection, while for Gaia and the global metasystem it would be the maximization of the capacity of the systems to dissipate the energy gradients maximizing the entropy production [1,24]. In both cases, the interaction patterns of the components of the *k* **S** systems and **MS** metasystem are automatically selected through the synergy that produces the maximum benefit [2]. The above seems to indicate that the global metasystem exhibits characteristics of a CAS.

A characteristic of CAS is that they present macroscopic properties that arise from the interaction of their components. These emergent properties are those characteristics, potentials, properties or abilities that are not present in the individual components but that result from the interaction of the elements of an abiotic, biotic, technological or social system [25–29]. At each level of description or level of complexity, interactions occur that give rise to new emergent properties that are manifested in successively higher levels of description [30].

As an example, individuals develop populations; these populations present properties that, on the one hand, are not predictable from those of the individuals that make up the population and, on the other hand, do not depend on the particular species of individuals that form them, that is, they are timeless phenomena independent of the identity of a specific species, which undoubtedly have existed and there will be in the time scope of complex ecological systems. Subsequently, the populations of some species interact with those of others forming groups that we call communities, these are then grouped in the so-called ecosystems and so on until they reach the biosphere. When the biosphere interacts with the magnetosphere, atmosphere, hydrosphere, and geosphere, a global metasystem is formed that seems to be a CAS with emergent properties not present in the previous area of complexity from which it arises. Those emerging properties are those that would define the conglomerate called global metasystem.

The process that gives rise to the emergent properties is automatic, with each change of complexity scope the successive metasystems **MS**, show new properties qualitatively different from those of the *k* **S** systems present in the previous description level [31]. Another characteristic of the emergent properties that result from the CAS is that the interacting components of the complex system are not aware of the new properties, because they are located in a different description scope.

An example of the above is the human organism; a system made up of cells that manifest emergent properties such as synesthesia, visual or auditory senses, consciousness and awareness of having a conscience, etc. The human organism is made up of multiple cellular elements, some 3.72x1013 human cells [32] and something like the triple in the number of bacterial cells (the microbiome) that together form a polygenomic metaorganism. A human individual is a metaconglomerate of individual organisms that are grouped in a cooperative and indivisible way [33].

The ordered and functional interaction of the set of cells generates a metaorganism. The cells or subsystems form systems $\mathbf{S_1, S_2, \ldots, S_k}$ that are grouped in different scopes: cellular aggregates, tissues, organs, etc. with control processes **C** building an metasystem **MS** that manifests itself as a human being conscious of itself, as a biological complex that is subsequently modified in terms of its behavior by the prevailing culture. Human culture is, in turn, a metasystem formed by the interaction over time of human individuals and the environment [34].

It is interesting to note that the awareness of being conscious, a distinctive feature of humans, is an epiphenomenon that emerges from the functional organization of cellular components and is not found among the properties of individual cells. This awareness of the functional complex that we perceive as "oneself" does not communicate in any known way with the parts of the system, with the cells, or with their successive aggregates or modules that we call tissues, organs, and organic systems. The resulting metasystem, the consciousness that we perceive as "oneself" is not aware of its cellular components, except in the sense of the perception of emergent properties such as the sense of balance and the need for food, among others.

In fact, the knowledge we have of the components of the human organism (cells, tissues, and organs) is indirect, comes from studies carried out in other individuals, it is not self-knowledge of the metasystem that we call "oneself." Neither do the parts of the metasystem "self" seem to be aware of the epiphenomenon of human consciousness that they generate. This incapacity is the result of the failure of the whole-complex to communicate with the components. It is possible that this incapacity has an intrinsic design basis, maybe is a way to protect the operation of the emerging metasystem [35]. The metasystem **MS** emerges from the interaction of the *k* **S** components through a self-organized process (regulated by control mechanisms **C**), but the components are not directly informed or aware of the metasystem they form.

It is a characteristic of complex systems that self-organize forming nested or hierarchical structures: with systems containing other subsystems [2]. Therefore, if we now place ourselves in a different description field than the one described above for cells and the human organism, the process occurs similarly.

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The example refers to the populations of different organisms (including humans) and their physicochemical environment. In the same way as it happens with the cells that are organized in tissues, organs and systems that make up a human organism, the different species, populations, communities and abiotic components interact with each other in direct and indirect ways, forming a gigantic network of interrelations which give rise to an **S** system that is called a biosphere or Gaia, which interacts with the geosphere, hydrosphere, etc. and it gives rise to the global metasystem, with properties and possibilities qualitatively different from those of the components of the subsystems operating in our complexity scope.

Human consciousness occurs in individual entities that perceive interactions with other individuals of the same species, or of other species, at little spatial and temporal scales. Direct experience allows us to know, study and obtain benefits of the components in our same complexity scope: agriculture, fishing, livestock and forestry in the biosphere, mining and energy production in the geosphere and hydrosphere, etc. However, we are not directly aware of the complete set of components (magnetosphere, atmosphere, geosphere, hydrosphere, and biosphere) and their interactions in global space and time, which is what would lead to the existence of the global metasystem.

It can be assumed that the global metasystem is quite old, probably forming during the first stages of the evolution of the planet. As in all complex dynamic systems [2], the characteristics and capabilities must have changed as their components have evolved and have been modified through the geological ages. In this sense, the question could be asked whether the modifications made by humans in the global environment could in a certain way change the characteristics not only of the biosphere, which is a well-described fact [15], but also imposed transformations on the global metasystem through bottom-up effects. Equally, the question would be whether the global metasystem in turn, by a type of top-down regulation [27,31] would impact in some way on the set of systems from which we obtain sustenance and living space.

4. The relevance of the understanding of the global metasystem

The global metasystem is outside the scope of human experience or of other organisms. The communication between global metasystem and living beings is not possible because they are functioning in different temporal and spatial scales, as well as in different complexity scopes. The above means that exists an abyss of direct communication between the two types of natural phenomena. What, then, would be the practical utility of considering an abstract global metasystem that is far from human experience?

In the first place, it is likely that the idea has some philosophical value. Greater understanding of the global metasystem may change the concept of the role of humans in planetary evolution. This change could be translated into a humbler vision of the functions of humans in the global metasystem, should turn into more sustainable and respectful of nature lifestyles [36]. In the same way, the consideration of the possibility of the existence of a global metasystem could contribute to new paradigms and changes in the systems of thought and beliefs.

From a practical point of view: why the idea of the global metasystem is transcendent? First, because the issue of emerging properties in complex systems is relatively poorly understood [35]. Perhaps the practical possibilities of studying this global metasystem could broaden the multidisciplinary interest in the subject. Second, the functional importance could be considerable since humans are immersed in the global metasystem as a component in interaction with other parts.

The current escalation of the population and use of material resources, energy, and information lead to the question: In what way does the metasystem adjust to the changes and possible bottom-up regulation imposed by organisms in the biosphere? Does some top-down control occur in response? Phenomena such as these occur in other complex systems. One example is the microbiome and the human organism, finding that the actions of the whole organism impact the behavior of the microorganisms and vice versa [37].

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An example of the impact of the biological activity on a planetary scale is the great oxidation event (GOE), located by the fossil record around 2200-2450 million years ago [38]. The GOE was the result of evolutionary innovation, oxygenic photosynthesis, which radically changed the configuration of the biosphere and turned it into a more effective system for the dissipation of free energy. It has been calculated that the amount of C fixed, thanks to the anoxygenic photosynthesis prior to the GOE, was 2 to 20 x 10^{12} moles of C per year (from 24 to 240 million tons of C per year), while the primary productivity Current, the result of continental and oceanic oxygenic photosynthesis, allows to fix about 9000 x 10^{12} moles of C per year, an amount of 450 to 4,500 times higher [39]. This substantial difference in the volumes of C metabolized by photosynthetic organisms implies a greater dissipation of energetic gradients by the biosphere.

In addition to the higher capacity for energy dissipation and changes in the metabolic strategies of organisms [40], the presence of free O_2 radically changed the composition of the atmosphere allowing, by example, the accumulation of O_3, with the consequent filtering of UV-C and UV-B radiation. This process permitted many prokaryotic life forms to no longer remain underwater or forming biofilms with a large quantity of antioxidant compounds and UV-C and UV-B absorbing pigments in terrestrial areas. The additional energy budget that was available could be channeled towards a higher rate of growth and reproduction.

Perhaps the most important consequence of the GOE was the possibility of starting to form symbiotic societies among prokaryotic unicellular organisms. As a result of the decrease in UV irradiance, it was no longer necessary for all cells to allocate almost all their metabolic capacity to the protection and dissipation of excess energy from UV-C and UV-B photons.

UV filtering by O_3 also changed the energy situation in the biosphere: UV radiation became a small part of the composition of solar radiation, becoming visible (380-800 nm) and infrared (800-2500 nm) radiation in the primary source of electromagnetic energy. Is it possible that these adjustments were global metasystem´s response to the change in the luminosity of the sun? [41].

After the beginning of the GOE, other biological innovations arose: multicellular organisms [42] and the presence of endosymbiosis [43] that triggered the evolution of eukaryotes. These innovations allowed to multiply the metabolic capacities and production of entropy of the biosphere.

The beginning of the GOE is believed to coincide with the appearance of organisms with oxygenic photosynthesis, dated about 3200 million years ago [40]. The production of O_2 by these organisms, over time, changed the composition of the atmosphere, oceans and continental water and the components of the geosphere. There were, however, other significant changes, precursors or coincident with the GOE, which seem to indicate that the event was the collective result of biological and geological processes, that is, biology and geology interacting and modifying each other [40,44].

The changes, especially those before the GOE seem to indicate a complicated process guided through a series of adjustments in the systems that led to the increase of O_2 or to inhibit the ability of the primitive biosphere to remove the O_2 of the environment. As examples of the changes above that increased O_2, there is the release of sulfates in the oceans, generated from SO_2 produced by volcanism [45]. On the other hand, the decrease of Ni flows from the geosphere to the oceans had a negative impact on methanogenic organisms and atmospheric CH_4, which diminished the capacity to eliminate O_2 [46].

In this regard, it is interesting to ask whether the GOE was carried out under some top-down regulation by the global metasystem. There is a possibility that this could happen, since, if the *k* systems **S** that make up the metasystem **MS** are organized in such a way that some regulation of the interactions occurs, then necessarily the regulation or control system must be meta-structural [47], so it is expected to happen a top-down control of **MS** over the *k* systems **S**.

Billions of years after the GOE, in the last 2.5 million years, we have human intelligence in action, which, like oxygenic photosynthesis, arose through the evolutionary process and the confluence of a large number of climatic, geological, and biological events. As occurred when the GOE promoted the arrival of metabolic innovations that increased the capacity for dissipation of free energy, at present, human intelligence through industrial technology uses significant amounts of

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primary productivity and other natural resources [36], creating previously non-existent products such as the transmission of culture through extra-biological means, the technologies to process and store vast amounts of information, biotechnology, nanotechnology, artificial intelligence, exploration of other planetary systems, etc.

Is it possible that it is interpreted as in the case of the GOE at the beginning of a new reconfiguration (now by intelligence ([48,49]) of a part of the systems in which life is immersed? If so, what might be the impact of these changes on the dynamic adjustments of the global metasystem?

As a partial answer to the last question: from the point of view of the properties of the CAS it has been proposed that the components of the systems have a significant impact on the properties of a metasystem, but possibly with less magnitude to the contrary; at least on time scales of change in ecosystems that can range from hundreds to thousands of years. It is assumed that control exerted by the emerging entity on the individual behavior of the units from which it arises is lax [18]. Therefore, the relevant effects are expected to go bottom-up [35]. However, it has also been proposed that the new properties of metasystems or emerging entities can have a substantial effect on the behavior of the *k* systems or components that produce them, through top-down regulation [27,31,50,51].

Again, the analogy of eukaryotic and prokaryotic cells that make up a human organism is useful. The emergence of the conscious 'oneself' is based on interactions at the level of cells, tissues, and organs, but 'oneself' further develops complex behaviors associated with exploration, future expectations, the search for food, refuge, and companionship, memory, learning, etc., that are inaccessible to the individual cells that are the basis of this biological construction. In this same sense, the global meta-system discussed here would be a different category of existence, little or not conscious of the presence of living units and other systems and their interactions from which it emerges. In spite of the above, the adjustments in the behavior of the global metasystem could have an impact on the systems from which it arises [47], since the changes would imply alterations in the flows of matter, energy, and information of the *assemblage* of components in dynamic interaction.

5. The study of the global metasystem

If one considers the possibility that intelligence constitutes the innovation to drive a subsequent change or evolutionary phase in the terrestrial system, then it is relevant to attempt to study and understand the current and future interrelation between the global metasystem and its components, in particular with humans and the biosphere.

It would be necessary to have adequate models, a large volume of data of the systems that form it and sufficient computing capacity to access knowledge about the behavior of the global metasystem. The construction of models of this kind necessarily requires large amounts of data to explore patterns and possible functional associations, considering even the data of solar and synodic activity. A potential source of such data is the fossil and paleoclimatic records as well as the recent databases about the climatic activity, of volcanism and seismicity, magnetic and gravitational activity. One limitation for these databases is the relatively short time that they are available. Another limitation is that the validation of the models would require long data collection times or information from other planetary metasystems.

With a critical minimum of knowledge about the global metasystem, there are some questions that could be explored: what is the importance of the global metasystem in the planetary and life evolution? Is it possible that the human species plays a vital role in its evolution? Or, on the contrary, once the global metasystem emerged from the interactions of the different systems and became functional, does it play any role in the evolution of organisms, including humans? Surely these and other questions are relevant in a framework of sustainable development and planning.

6. Conclusion

A speculative argument was presented on the possibility of action of a global metasystem that arises as an emergent property of the interaction of the abiotic and biotic components of the magnetosphere, atmosphere, geosphere, hydrosphere, and biosphere. Some implications and the potential importance of greater knowledge about the proposal were discussed.

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