

# Planned satellite increase will damage Earth's lifeconditions

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## Introduction

For the spring session 2020 the Norwegian national assembly has scheduled a debate over a white paper from the cabinet, regarding a national venture into the satellite business. (*Meld. St. 10 (2019-2020) Høytflyvende satellitter - jordnære formål. En strategi for norsk romvirksomhet.* [High-flying satellites - down-to-earth purposes. A strategy for Norwegian space activities])

Our written contribution to a consultation on the white paper in the Assembly's Committee of Commerce was our first version of this paper. We then made a slightly different, improved version for translation, less specific as to the Norwegian circumstances.

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During our work on health and environmental consequences of human use of electricity and radio waves, we have become aware of major environmental damages uncovered by a few, small research groups doing *interdisciplinary* research - the only way to detect and understand these damages. These scientists' serious messages are easily drowned in the enthusiasm for new technology and opportunities for economic growth, new jobs and new revenue streams.

It seems that in most countries, no entities of the government, nor any research organizations or groups, have responsibility, knowledge, or activities covering such interdisciplinary issues.

However, the message from these small and dispersed research communities is far-reaching: *The damaging effects on the electromagnetic field surrounding the Earth from radio transmitters on the ground and in space have been ongoing for a long time, and are today clearly observed and verified in tests. The mechanisms are well documented. We cannot maintain or increase the use of radio communication without increasing these damaging effects on the conditions for Life on Earth.*

These interdisciplinary scientists' studies show that radio waves impact the climate on Earth and the conditions of Life in a variety of ways. Here we present very briefly the most important and best studied mechanisms, and we provide a small selection of references - in part in the form of popularized texts, in part regular scientific studies. The research we refer to, is based on traditional physics and chemistry, and requires no "alternative" or controversial data, nor any such ways of reasoning.

This is knowledge that is rarely known to *physicists*, who are normally quite unfamiliar with biology. Neither has this knowledge been taken into account by the *climate scientists*. E.g., it is missing in the climate models used by the IPCC, a fact NASA has criticised. *Biologists* and *medical doctors* have educations that usually do not extend far enough into space for such topics to be part of their education. Hence, the specialists have blinders, making them unaware of the full picture. Therefore, the *engineers* and *business interests* do not meet any well-founded opposition from such specialists, nor do politicians get more than presentations from interested parties and experts with tunnel visions.

Hence, those pushing for the increased use of wireless communication - broadcast as well as bidirectional, are lacking knowledge about the resulting changes in the Earth electromagnetism - whether they are created by normal or abnormal, natural or man-made radio signals - and the

biological effects thereof. At the same time, many people suffering from rheumatism, as well as many others, experience such effects in the form of a set of symptoms often called "weather sickness", not knowing that it is caused by the electromagnetic changes in their environment originating in electromagnetic processes found in the huge weather systems enveloping the Earth. The small, interdisciplinary research groups sounding the alarm about this larger connection between biology and electromagnetism, are seriously concerned, as their warnings are not listened to.

*The present international push for communication satellite networks will contribute to the global community running into an ecological dead end by weakening Earth's sustainability, contributing to reduction of public health in general, as well as the health of the environment, for our own as well as for future generations of all life on Earth.*

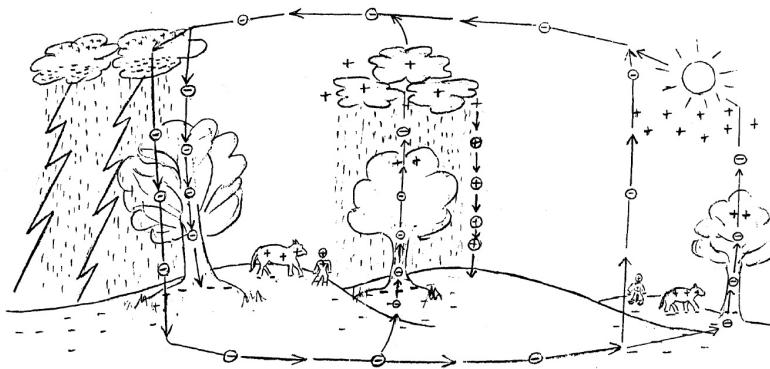
Towards the end of this paper, before the conclusion, we discuss the main argument raised against the concerns presented below.

### ***Three mechanisms that make a commitment to satellite deployment incompatible with a sustainability strategy***

#### **1. Damage to the electric cycle that makes the Earth a habitable place**

Life on Earth is maintained by an electric circuit which is driven by heat and electric charges that radiate from the sun, and through the atmosphere reach down to the Earth's surface. From the Earth's surface, electric charges also radiate upward into the atmosphere (Figure 1).

Life on Earth depends on this electric circuit. It can be measured. The radiation from the sun, interacting with the electric circuit, shapes the weather systems, and it is absorbed and utilized by all living beings. We see some of it as lightnings and as St. Elm's fire, precipitation (rain) takes its part in it, and it provides energy to the nutrients we eat. All lifeforms are finely tuned to, and adapted to, benefiting from this circuit.



*Figure 1: Earth's electric circuit (Firstenberg 2017)*

This circuit can also be illustrated so that the inclusion of the sun in the circuit becomes more visible, as well as the flows back and forth, as in Figure 2 and Figure 3.

**Life on Earth is closely connected to electromagnetic variations** of various kinds, among others to the intensity variations of the Earth's magnetic field. Solar storms' huge impact on the Earth's magnetic field has been extensively studied (though in no way exhaustively). The solar influence is found to be reflected in *morbidity statistics*, in the variations in certain *blood levels*, in *virus mutations*, and in *influenza epidemics*. The latter has been known and observed by medics and

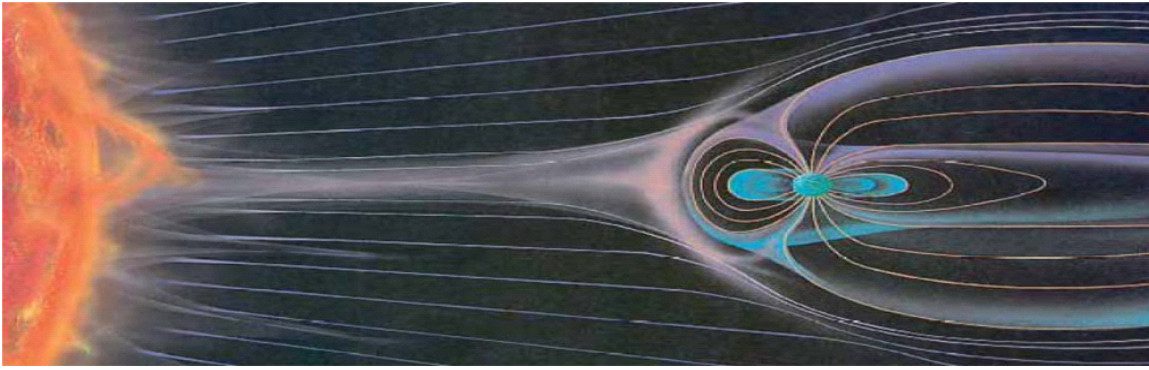


Figure 2: The flow of particles from the sun affects the earth's magnetic field, which preserves and enables life on Earth (from Zaporozhan, V., & Ponomarenko, A. (2010)

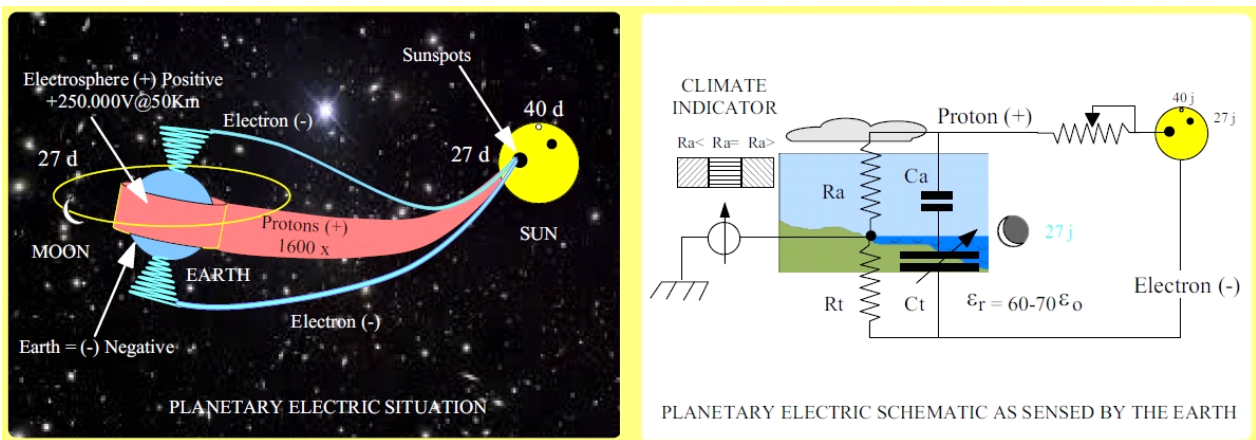


Figure 3: The electric circuit between the sun and the earth - two different modes of illustration (Société Française d'Electrostatique 2016)

astronomers since antiquity and is supported by modern chemical analysis and research in epigenetics.

The electric circuit and magnetic field can be distorted in various ways. Such disturbances, whether from nature or due to human activity, create *biological reactions* - both in the short and long term. The electrochemical processes resulting from human activity and described in the following sections, show some of these adverse effects. What they have in common, is that the potential consequences for life on Earth are significant, potentially crucial.

Observations show that the current use of electricity, radar and radio signals is affecting the ionosphere and the atmosphere, and, thus, the Earth's climate and environment. Predicting all potential adverse effects from current and future increased use, is not possible with any scientific certainty. Also, some effects cannot be proved until the damage has actually occurred. As the adverse effects from current use of electromagnetism are already detected, it is therefore not justifiable to continue such activities until proofs exist – and not advisable to further increase usage.

*The initiative to massively increase the number of communication satellites taken by governments as well as private enterprises, represent a significant increase in the manmade impact on the Earth's electromagnetic field. From the knowledge conveyed here, it is highly irresponsible.*

### Literature:

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Zaporozhan, V., & Ponomarenko, A. (2010). Mechanisms of geomagnetic field influence on gene expression using influenza as a model system: basics of physical epidemiology. *International journal of environmental research and public health*, 7(3), 938–965)

## 2. "Electron precipitation" breaks down the ozone layer and raises the temperature

Outside the atmosphere, the globe is enveloped by the *ionosphere*, and, further out, the *magnetosphere*. These layers make up Earth's "electric shield". They protect life on Earth from the solar wind, i.e. radiation from the solar storms, as well as against other harmful radiation from space.

Radiation from solar storms causes the ionosphere to precipitate electrons, which then fall as "*electron precipitation*" (also called *energetic electron precipitation* or EEP) down into the upper layers of the atmosphere. This has been shown to lead to increased formation of NO<sub>x</sub> compounds, which damage the ozone layer, near the poles in particular. The ozone layer protects life on Earth from UV radiation and heating. Fortunately, new ozone is formed quickly enough to make up for the breakdown from the natural EEP. This cycle has been in balance for eons. and varies with the solar storm cycles of about 11.3 years each.

Figure 4 shows how the radiation from solar storms affects the Earth's temperature, causing the temperature to rise when the solar wind is at its strongest. The Earth's temperature (in red) varies with the solar storm cycles (in yellow) - right up to around 1960. Then the temperature began to rise, deviating sharply from the solar storms: *Obviously, there must be something else but solar storms causing the temperature rise.*

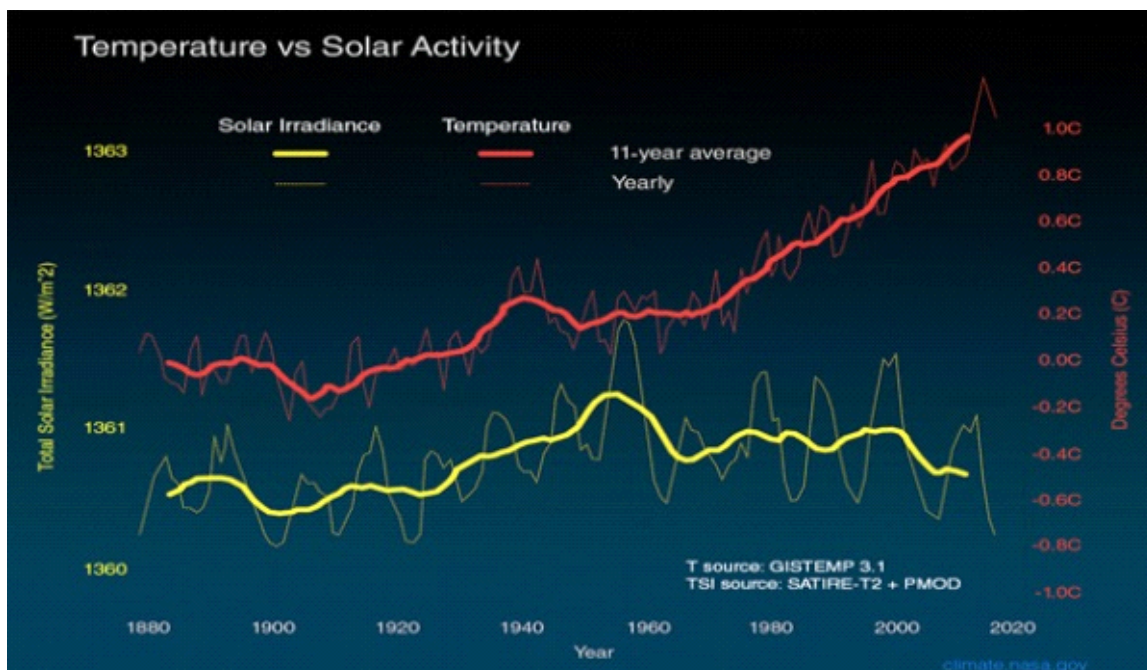


Figure 4: Illustration from NASA showing the relationship between solar storms and temperature variations (source: NASA)

The IPCC's climate models do not include EEP, and therefore do not model climatic effects due to such events in the ionosphere. The IPCC's climate models assume industrial and car pollution, as well as other chemical man made substances, to be causing greenhouse gases, which in turn create the temperature rise.

However, EEP triggered by radiation from wireless communications - which adds to the radiation



from the solar storms - seems likely to be the main reason for atmospheric processes, which in turn cause the temperature rise, as we shall see below.

**Man-made electromagnetic activity** on the ground affects the ionosphere and the magnetosphere, as the electromagnetic radiation created by us, reach all the way up to these layers. The radiation from various man-made sources can be measured in the high-altitude ionosphere and magnetosphere. Among these sources are radio transmission towers and high voltage electricity grids on the ground.

Military submarine communications make use of the ionosphere and magnetosphere to transmit signals, precisely for their ability to be modified to carry very low frequency (VLF) signals around the globe. In doing so, they affect particles in the ionosphere and magnetosphere in the same way as solar storms do, creating EEP. And, as we have just learnt, the EEP is followed by increased formation of *NOx compounds* that damage the *ozone layer*.

From this it can be concluded that it's not only CFCs (Chlorofluorocarbon) and other chemical compounds from human activity that break down the ozone layer: The ever-increasing use of radio waves is an essential - perhaps the most important – factor, as this factor is the one that has clearly increased the most over the last hundred years.

The fact that human use of radio waves actually does create EEP, has been verified by several military experiments, where increased EEP from VLF transmitters have been measured.

Figure 5 shows that temperature has increased in tandem with the deployment of radio systems, and that it has accelerated with the strong growth in broadcasting and wireless communication on the ground, as well as with the increase of satellites for radar, observations and communications.

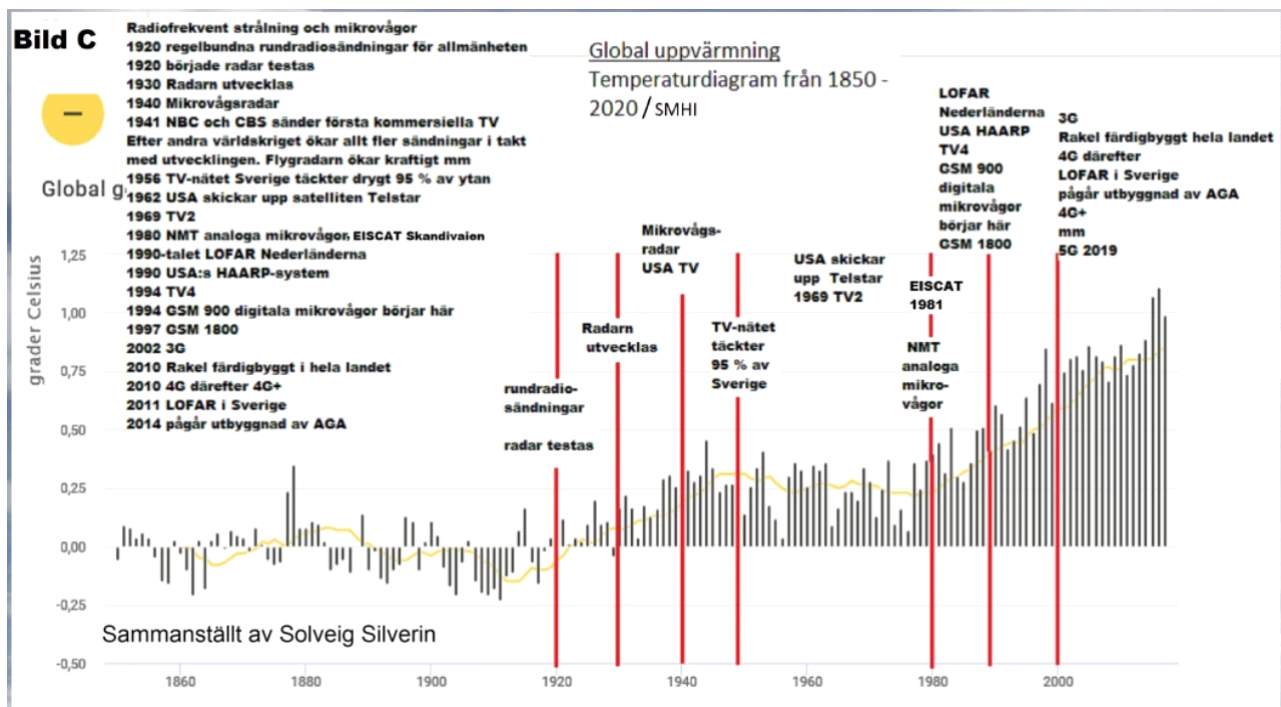


Figure 5: Global warming follows the development of wireless communication, and thus with it, the "electron rain" that creates *NOx*'s that break down the ozone layer. (ex environmental consultant, biologist Solveig Silverin)

Figure 5 also shows a flattening of the temperature rise during a period around 1960. Some researchers claim this to be caused by frequencies used for TV broadcasts interfering with other frequencies in such a way that they for a period counteracted their effects on the EEP, thus temporarily permitting the ozone layer to recover.

**Communication satellites will create EEP** when placed in or near the ionosphere and the magnetosphere, as they will, in a very direct way, affect the ionosphere just like solar storms do.

*It can therefore be expected that an increased number of communication satellites will lead to a weakening of the ozone layer and increased UV radiation down into the atmosphere. Thus, it must be expected to cause an increase in the Earth's temperature.*

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NASA: [https://climate.nasa.gov/climate\\_resources/189/graphic-temperature-vs-solar-activity/](https://climate.nasa.gov/climate_resources/189/graphic-temperature-vs-solar-activity/)

«Raining» Electrons Contribute To Ozone Destruction, Date: December 15, 2000 fra NASA/Goddard Space Flight Center--EOS Project Science Office <https://www.sciencedaily.com/releases/2000/12/001215082423.htm>

Priyanka Bandara, David O Carpenter, Planetary electromagnetic pollution: it is time to assess its impact, The Lancet Vol. 2, December 2018, pp 512-514

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## 3. Life's electromagnetic control signals will be disturbed

It is well known among experts, and well documented scientifically, that humans, animals, insects, birds and other lifeforms depend on a variety of electromagnetic pulses that are naturally occurring in our environment. All life forms examined depend on such pulses. All life forms also create even weaker pulses themselves which are used to coordinate life functions, for navigation, for communication, and more. This applies right down to the cellular level, e.g. in the heart, where pacemaker cells produce electrical pulses that coordinate chemical processes, so that the cells work in unison to produce the heart's pump-function. Even bacteria communicate with electrical signals.

When humans are completely shielded or isolated from the pulses of nature, their bodily functions deteriorate after just a few days. The strength of the pulses is not crucial: life forms react to the pulses even though they are extremely weak. It is also well documented that «weather sickness» results from biological reactions to very weak pulses with specific frequencies, originating from electrical discharges in weather fronts.

Researchers find that precisely those animals which are found to be sensitive to the signals from man made electromagnetic fields, and are dependent on using Nature's pulses or magnetic or electromagnetic fields for orientation, are the ones which are now fast disappearing.

A kind of "Nature's basic frequency", created by resonance from lightnings, is the well-known and well-documented *Schumann frequency*. This frequency (about 7.8 Hz, as well as its harmonics) originates from huge electrical discharges, lightning, “echoing” back and forth between the Earth's crust and the ionosphere. The natural, regular changes in the Schumann frequency control *circadian rhythms* and seasonal variations in plants and animals. The Schumann frequency is so important that it is artificially recreated in space stations to keep astronauts (and cosmonauts) healthy.

It is well known that disturbances in the electromagnetic field of the ionosphere cause changes in the Schumann frequency. When satellites emit electromagnetic radiation in or near the ionosphere, this will necessarily affect the way the ionosphere reflects electromagnetic waves, and will therefore also affect the Schumann frequency - without anyone being able to predict exactly how.

Such impacts to the natural Schumann frequency are likely to affect life on Earth negatively, by causing significant damage in the form of increased general morbidity. The mechanisms are diverse, and in part well mapped out. The impact is likely to manifest itself along a broad spectrum of thinly distributed incidents of damage that may appear acutely, or only gradually after many years. It should also be expected that establishing a clear cause, might be difficult, as is regularly the case with environmental stressors and complex biological processes.

Among the small, quite subtle effects that have been detected by experiments, are changes in sleep patterns and feeding times, and various seasonal adjustments in animals, plants and humans. New «weather sickness» symptoms may also occur, as satellites affect the electromagnetic environment on Earth.

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### ***More communication satellites means less certain weather predictions***

In addition to the physical mechanisms mentioned above, there is a societal mechanism that is of great importance for sustainability:

Industrial societies are now dependent on high reliability weather forecasts in order to function efficiently. It is generally difficult to reverse a society in orderly ways from a more, into a less efficient way of work. (It was tried out in Cambodia under Pol Pot, and after World War II in occupied Western Germany with the Morgenthau Plan.) Hence, poorer reliability in the forecasts may give our societies significant additional burdens. The reason for concern in this case is not in the use of radio waves as such, but in the frequencies assigned for communication:

New frequencies used for 5G, both on the ground and to, from and between satellites, raise strong concern among meteorologists, as the frequencies will create "noise" that disturbs weather radars. Therefore, meteorologists have warned that satellites transmitting at certain frequencies, including the frequencies intended increasingly to be used for 5G, will function as radar jammers, significantly reducing their ability to provide reliable weather forecasts. Some meteorologists remark that the reliability of weather forecasts will be set back by several decades.

Meteorologist Tony McNally of the European Centre for Medium-Range Weather Forecasts in

Reading, UK, states:

*«The way 5G is being introduced could seriously compromise our ability to forecast major storms. In the end it could make the difference between life and death. We are very concerned about this.»*

Developments in the United States have already weakened the ability to collect accurate weather data: Weather radars use the resonance frequency of water vapor, which is 23.8 GHz, to detect the vapor in the atmosphere, which in turn is used for the large calculations behind today's weather forecasts. 5G satellites are assigned frequencies very close to the water vapor frequency: the United States Telecom Authority FCC (Federal Commission of Communications) has recently auctioned two frequency bands for 5G satellites - one between 24.25 and 24.45 GHz and the other between 24.75 and 25.25 GHz.

The lowest frequency band, in particular, could easily interfere with the 23.8 GHz frequency on which meteorologists depend. In part, the weather over the USA determines the weather in Europe 3-4 days later. Hence, poorer forecasts in the United States will have an impact on weather forecasting services in Europe as well. Disturbances created by the frequency allocation, will thus greatly affect the ability of many countries to have good and reliable weather forecasts.

Meteorologists accuse telecom operators of "vacuuming up" the radio frequency spectrum for frequencies they can exploit, and they blame the government bodies in charge for not protecting the resonant frequencies, which are absolutely necessary to make observations of the Earth from satellites in space.

*States do not control which frequencies other states assign. However, the use of frequencies for worldwide communication is by and large regulated through international bodies. Government bodies in several countries have been made aware of the problem of the interfering frequencies. The use of such frequencies may offer shortsighted gains in terms of economic growth, workplaces and revenue streams, but huge long term losses. Governments should use this knowledge to avoid the use of such frequencies, both on the ground and in space, rather than promoting technology using it.*

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## **What are the arguments against these warnings?**

The only significant objection we know about, as to the explanations and warnings we have presented above, is *the claim that compared to the energy that reaches us from the sun, the radiation from satellites will be so insignificant, that it will have no impact whatsoever.*

We present this argument in more detail below, as we received it by private email from an astrophysicist and friend, working in the satellite sector. We comment on it thereafter:



**Counter-argument:<sup>1</sup>**

*I completely rule out that there could be any reason for concern that satellites are able to interfere with the Earth's electric circuit. This is shown by the following calculation:*

- *On average the sun's electromagnetic radiation reaching the Earth is of an intensity of  $1360 \text{ W/m}^2$*
- *Out of this, a small part arrives in the form of what is called radio waves. The percentage will depend on how radio waves are defined. To exaggerate, let's say 1 %, just over  $10 \text{ W/m}^2$ , reaches the Earth in the form of radio waves.*
- *All the satellites (50,000 is probably a little much, but to be on the safer side, let's say 100,000), get their power from solar panels. Let's exaggerate again, and say they are emitting at  $100 \text{ W}$  each.*
- *In terms of energy, radio waves from the sun hit us by about  $3 * 6000 \text{ km} * 6000 \text{ km} * 10 \text{ W/m}^2 = 3 * 36 * 10^{12} * 10 \text{ W} \approx 10^{15} \text{ W}$*

*The ratio of energy supply will then be, solar/satellites, i.e.  $10^{15} \text{ W} / (10^5 * 100) = 10^8$*

**Our answer:**

This calculation tells us that the energy emission from satellites down to Earth is vanishingly small: only 1/100,000,000 - one hundred millionth - of the energy arriving from the sun - and therefore nothing to worry about. According to the astrophysicist, even in a "worst case scenario" with unrealistically high emitting power and unrealistically many satellites, the radio wave emissions from the satellites are insignificant.

However, for a start, it seems that the astrophysicist is wrong with quite a few orders of magnitude as to the satellites' emitted power - in terms of the strength of its impact:

Expected powers are around 100 Watt, or may be a few hundred Watts (measured as EIRP). The emitter directs this power as a concentrated beam through the spheres towards the ground. Such powers, as we informed (Firstenberg, email 6.4.20), correspond to 5 million Watts for high orbit satellites and 0,5 Watt for low orbit satellites, when converted to an isotropic antenna, i.e. one emitting with same power in all directions. The impact per exposed area will therefore be as if from isotropic emitters of respectively 5 million and 0,5 Watts.

This shall be possible to extract from documents from the USA Federal Communications Commission. Pending Application for Satellite Space and Earth Station Authorization. Schedule S, Technical Report. Dated April 2016, filed March 1, 2017.

[http://licensing.fcc.gov/myibfs/download.do?attachment\\_key=1200245](http://licensing.fcc.gov/myibfs/download.do?attachment_key=1200245)).

But never mind the figures. The astrophysicist objection still rests on a lack of knowledge about scientific research on how radio waves affect the Earth and what lives there. From the research results we have presented in this note and known facts about the sun's rays, we have the following remarks to his objection:

- The objection demonstrates a lack of knowledge as to what is needed to trigger electron precipitation, EEP, and the subsequent degradation of the ozone layer, with subsequent temperature rise.
- The objection demonstrates a lack of knowledge about the dramatic difference between mainly *non-polarized waves* from the sun (except during solar storms), and the always *polarized waves* from radio antennas. The polarized waves carry electromagnetic charges

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<sup>1</sup> Please note that in this version 1.4 of this note, there are essential corrections in the orthography of the calculations, as well as corrections done in the following paragraphs. EF and EN.

and can therefore impact and interact with charged groups in biological systems and charged particles in the atmosphere. Non-polarized waves do not carry any electromagnetic charge, and are therefore unable to engage in any such interactions.

- The objection demonstrates the objector not being aware that detrimental effects from today's use of electricity and wireless communication are already being detected in the ionosphere, and subsequently as destruction of the ozone layer.
- Using such an objection also shows the lack of insight into how the Schumann frequency and other low-frequency pulses that control biology, may be disturbed, and how human use of such pulses in radio communications interfere with biology, resulting in significant health and environmental effects.

The astrophysicists' objections based on his own thorough knowledge of his own field of physics is simply all too limited. His assessment falls short of assessing the true impact of the satellites. It demonstrates the importance of bringing in knowledge from other fields of science in order to assess the impact from radio wave emitting satellites on all life on Earth and on the climatic conditions on which we depend.

## Conclusion

Interdisciplinary research shows that deploying communication satellites in space, whether in low or high orbits around the Earth, is likely to have huge impact on the conditions for Life on Earth.

The planned launch of a huge number of satellites will significantly impact the ozone layer, the climate, and the conditions on Earth for all living beings. It will also have direct impact on specific health conditions, as well as on general morbidity, and its subsequent social costs. Due to the consequences of a degradation of our weather forecasts, it might also impact the efficiency of modern society.

None of these potentially huge impacts seem to be taken into account when businesses and governments plan for a huge increase in the number of radio wave emitting satellites. Such impacts on the conditions of life on Earth cannot be outweighed by new business, economic growth or service development made possible through new satellite networks.

The deployment of tens of thousands of new communication and observation satellites, as presently planned, is a huge climate experiment. It is also a major biological experiment with all life on the globe as involuntary participants.

Committing to deploying technologies that have such a huge potential affect to all Life, raises a number of unsettling and serious *legal, ethical, and financial issues*. Among the legal issues to consider, is the fact that the country from where the launch takes place, is, by international law, legally responsible for all occurring damages. This might have some serious financial impacts.

But contributing to this development, rather than counteract and curb it, should, first and foremost, raise serious environmental and ethical concerns.

Participating in an effort to increase the number of communications satellites is not consistent with *the precautionary principle*, neither with general principles of *social responsibility* of corporations or governments (e.g. ISO 26000), and most certainly not in line with the aim of most states, businesses and organizations to stand forward with high ambitions for their environmental commitment.