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Solar Alpha Particle Radiation Increases Human Mortality – An Example from the Malignant Melanoma Mortality in the Europe and Mediterranean

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ABSTRACT

A dangerous phenomenon for humanity is described. In the joint analysis of data from satellites in orbit around the Earth and from the health statistics source EUROSTAT, it became clear that, by some mechanism, flows of positively charged particles with high energy entering the Earth's orbit increase mortality on the planet's surface. The increase in mortality is in a band of maximum risk in the Northern Hemisphere, parallel to the Equator and bounded by the parallels of 30° and 60° north latitude. Examples are given for the European Union mortality from malignant melanoma of the skin confirming the described phenomenon. A hypothetical mechanism based on observational evidence has been proposed, according to which this dangerous phenomenon is due to solar alpha particles of high energy sufficient to overcome the atmosphere's resistance and reach the Earth's surface in a limited area of maximum death impact.

Keywords: Mortality; Malignant Melanoma of the Skin; Satellites GOES; Cosmic Alpha Radiation; EUROSTAT

Introduction

In a series of publications [1-20], a dangerous phenomenon of cosmic origin for humanity was described – the presence of a high correlation between the flows of positively charged particles with high kinetic energy recorded from satellites in the Earth orbit and mortality on the Earth's surface from many diseases. The main focus of the mentioned publications was on the effect of solar alpha radiation on mortality from diseases, killer number one of mankind – those of the circulatory system. The harmful effects of solar alpha radiation are also observed on many other organs and systems in the human organism, turning this invisible effect into one of the main causes of death for humanity. The mentioned dangerous phenomenon of cosmic origin is unevenly spread on the planet's surface. Europe and the Mediterranean are among the most affected. However, in [1-20] are described many examples, where this phenomenon is also observable in several countries from the Northern Hemisphere – Asia, America, and even Africa. The European Union has a tradition of maintaining reliable mortality statistics, in which the discussed multifaceted influence of solar alpha radiation on mortality stands out clearly.

Below, based on data from mortality statistics in the European Union, the unexpected association between solar alpha radiation and mortality from malignant melanoma of the skin is shown. According to [21,22], 90% of recorded cases of the deadliest skin cancer, melanoma, are caused by excessive exposure of the skin to ultraviolet radiation, mainly of solar origin. Statistical data show a drastic disparity in the incidence of the three types of skin cancer - basal cell carcinoma, squamous carcinoma, and melanoma, which is strange if it is assumed that all three types of cancer are caused by the same cause – ultraviolet radiation. Melanoma cases in the US are only 2% of all reported skin cancer cases [23]. This fact is probably related to different mechanisms of occurrence of melanoma compared to other types of skin cancer. In support of this statement are the results of 13 studies involving 7,700 cases of melanoma in people of color [24]. Research findings question the occurrence of melanoma as a result of exposure

to ultraviolet radiation in individuals of color. Below are the results of a study that reveals a new unsuspected cause of melanoma – high-energy solar corpuscular alpha radiation. The nature of the alpha radiation is different from that of ultraviolet radiation. The processes that alpha radiation can induce in the human body are more intensive than those induced by UV radiation. In addition, the high-energy alpha radiation can also ionize the atoms in the living organism, which drastically worsens the normal metabolism in living cells. This type of radiation may be the leading external cause of melanoma disease.

Material and Methods

Mortality Data

The analysis below is based on an authoritative source of health data – EUROSTAT [25]. In the study, the parameter annual mortality rate – number of deaths per 100,000 inhabitants was used as a characteristic of mortality. EUROSTAT offers free access to data on mortality rate from causes in the countries of the European Union, the European Economic Area, and the candidate countries for membership in the union. Geographically, these countries occupy Europe and the Mediterranean. Data are grouped by NUTS (Nomenclature Des Unités Territoriales Statistiques in French, the nomenclature of territorial units for statistics). In the study, were used mortality data from the EUROSTAT shortlist in which mortality rates are grouped by causes of death into 92 groups, mostly diseases. The groups are related to the classes in the International Disease Classifier ICD-10, (10th revision). The shortlist contains mortality data for EU countries (NUTS-1) and EU regions (NUTS-2, smaller areas of the larger NUTS-1 countries). Currently (2023) the shortlist includes mortality rate data for the interval 2011 – 2020. Annual mortality rate data were extracted for 353 European regions (NUTS-2) separately from each of the shortlist groups for the interval 2011 – 2019 (the last pre-pandemic year).

Satellite Data

Satellite data on corpuscular radiation – protons and alpha particles recorded by the satellites of the series GOES (Geostationary Operational Environmental Satellites) were obtained from an NOAA site [26]. The satellites of the GOES series fly in geostationary orbit (above the Earth's equator), at an altitude of 36,000 kilometers above the Earth's surface, make one lap in 24 hours, that is, they "hang" over a certain point on the Earth's surface and are not shade by the Earth at their circumference around it. Data on alpha-particle and proton fluxes (unit: (number of particles) $cm^{-2}.s^{-1}.sr^{-1}.MeV^{-1}$) with energies of the range 3.8 – 21.3 MeV were used. The fluxes were recorded by the satellite high-energy particle detectors: 1. Energetic Particles Sensor (EPS), and 2. Energetic Proton, Electron, and Alpha Detector (EPEAD). The data are available averaged over a 5-minute interval, during which there are up to 25 reports of the instrument.

Data Processing

The correlation coefficients [27] between the annual averaged alpha radiation flux and the annual mortality rate were calculated. A map was created showing (with black isolines) the distribution of the annual mortality for 353 NUTS-2 European regions from the EUROSTAT shortlist death cause: "Malignant melanoma of skin" (EUROSTAT mortality shortlist number 18), for 2012, the year with the highest solar activity in the studied time interval 2011 – 2019. With red isolines, the map shows the distribution across the territory of Europe and the Mediterranean of the correlation coefficient between the annual mortality rate from "Malignant melanoma of skin" with the annually averaged alpha particle flux for the time interval 2011 - 2019. Data on the coordinates, latitude, and longitude [Google Earth] of the centroids of the NUTS-2 regions included in the study were used in the map. Mapping was performed with Golden Software Surfer10. The kriging interpolation procedure was selected. In mathematical statistics, the level of statistical significance [27] is a parameter, indicating the degree of reliability of the calculated correlation coefficient. The smaller the number of this parameter, the more reliably the correlation coefficient is established, i.e. the more reliably a cause-and-effect relationship has been established, in the case between the annual flux of solar alpha radiation and mortality from a cause of "Malignant melanoma of skin". The correlation coefficient and the level of statistical significance are related.

For the 9 years included in the study, a minimum correlation coefficient of 0.668 corresponds to a statistical significance level of 0.05 [27]. In scientific studies, a level of statistical significance no greater than 0.05 is accepted as a criterion for the reliability of the correlation coefficient. The red isolines on the correlation coefficient distribution in the map enclose the regions with statistically significant values of the correlation coefficients around and up to a significance level of 0.05. Correlation coefficients with a significance level above 0.05 are of high reliability (the higher the number, the lower the significance level) i.e. the existence of a causal relationship between cosmic alpha radiation and mortality from the cause "Malignant melanoma of skin" can be considered reliably established in the mentioned areas enclosed by red isolines on the correlation coefficient. If there is a coincidence for some of the maxima for mortality rate and correlation coefficients, then in the region of these maxima, the impact of alpha radiation contributes noticeably to the mortality from "Malignant melanoma of skin". To the extent that the hypothetical mechanism proposed below explaining the observed phenomenon assumes that charged particles of high energy pass through the atmosphere and reach the Earth's surface, the energy required for this was calculated from databases and calculators PSTAR and ASTAR [28,29]. Geomagnetic field data were obtained from the INTERMAGNET site [30].

Results

The described dangerous phenomenon is observed in the form of dependence between the annual average flux of radiation from positively charged particles (protons and alpha particles) with high kinetic energy, recorded by satellites in orbit around the Earth, and the annual mortality rate in the statistics of several countries from

all continents in the Northern Hemisphere. The countries in whose mortality statistics the phenomenon is observed are located in a band parallel to the equator with approximate boundaries along the parallels of 30° and 60° north latitudes. It is observed in the annual mortality statistics of small countries. It is not noticeable in the statistics of large countries in the same band. It can be inferred that the impact on the Earth's surface is short-lived and over a limited area the size of a small country, but is masked in large country statistics because it does not affect the entire area of the large country at the same time. This conclusion is confirmed for the USA, for which there is data on mortality in individual states [10]. The mortality statistic of the European Union is suitable for the study because it is based on statistical regions, smaller than a country, but still big enough, to include a statistically sufficient number of inhabitants.

This phenomenon would be expected to influence mortality in countries south of the Equator, but mortality statistics for them are scarce, unreliable, or absent, preventing reliable inferences about such an influence in the Southern Hemisphere. For particle energies of the order of 3.8 – 21.3 MeV, the year-averaged fluxes of protons and alpha particles are highly correlated, i.e. the studied phenomenon of lethality is noticeable in both the mean proton flux and the mean alpha particle flux data. For the reason explained below, only the average flux of high-energy alpha particles is included as the incident radiation in the examples below. Figure 1 shows for the Europe and Mediterranean the distribution of the mortality rate for EUROSTAT shortlist deaths cause: „Malignant melanoma of skin" for 2012, the year of maximum solar activity for the studied interval, and alpha particle flux maximum (black isolines), and the distribution of the statistically significant correlation coefficient between solar alpha particle fluxes and the mortality rate for "Malignant melanoma of skin" (red isolines). The statistically significant influence of alpha radiation on mortality from malignant melanoma of skin is limited to a band parallel to the Equator with approximate dimensions between 40° and 60° north latitude. Not all high mortality areas in the study region fall into it. Over Denmark and Sweden, there is an area of high mortality from malignant melanoma of the skin in which the contribution of alpha radiation to mortality is not noticeable.

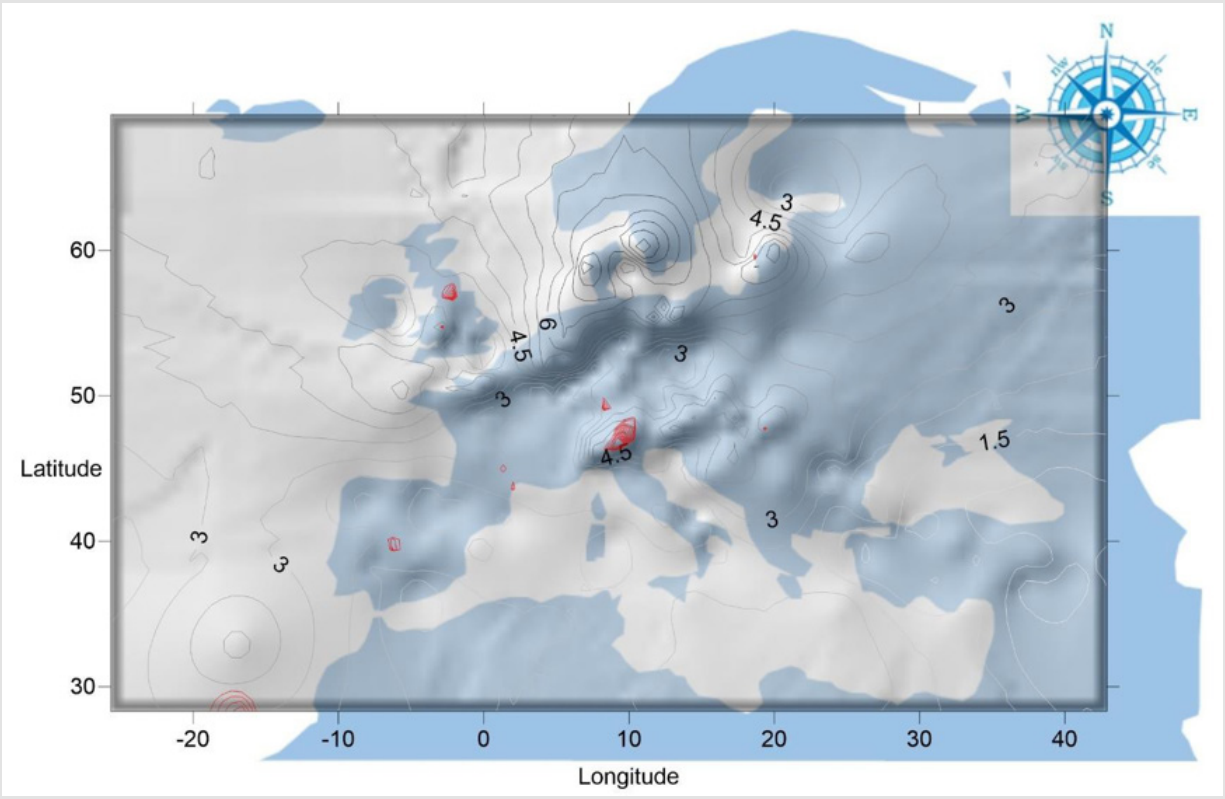

Figure 1: Europe and the Mediterranean, the "Malignant melanoma of skin" mortality rate for 2012 (black isolines), and its statistically significant correlation with annual alpha particle flux (red isolines) for the studied interval 2011 – 2019.

The impact of alpha radiation on mortality in the mentioned band does not continuously cover the entire band but is of the nature of limited spots in it, covering mainly mountainous areas. A pronounced effect – a statistically significant coincidence between areas with increased annual malignant melanoma of skin mortality and its correlation with annual alpha radiation flux is observed for the Alpine region (Italy, Austria, Switzerland), the Carpathians, the Pyrenees, and the Baltic countries. Central Spain and the Central United Kingdom are affected too. Figures 2-9 show the correlated changes in malignant melanoma of skin mortality with alpha radiation flux for these areas.

Figures 2-9 show the time dependence in the interval 2011 – 2019 of two numerical sequences:

- Of the recorded annual fluxes of alpha particles from satellites of the GOES series – 10, 11, 12, 13, and 14, and,
- Of the "Malignant melanoma of skin" annual mortality rate for some of the NUTS-2 regions of the European Union.

The high correlation between the two numerical sequences can be seen, indicating the existence of a causal relationship between them.

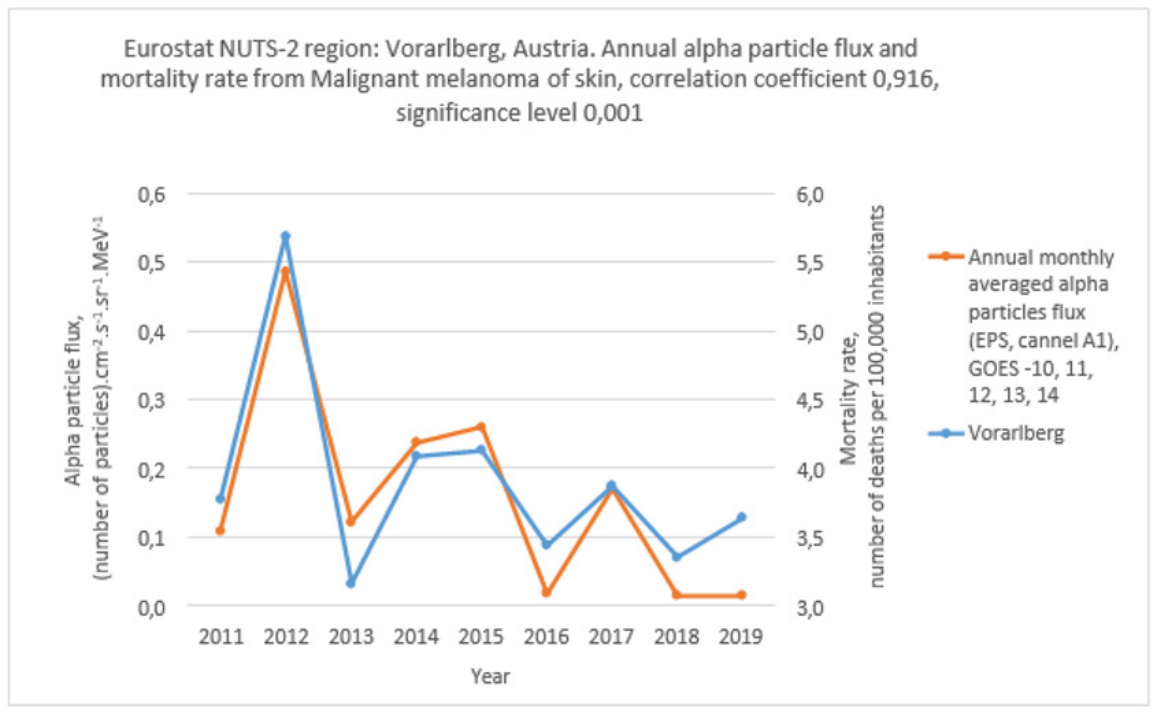

Figure 2: The high statistically significant correlation between annual fluxes of cosmic alpha radiation and the "Malignant melanoma of skin" mortality rate for the EUROSTAT NUTS-2 region VORARLBERG, AUSTRIA, indicates the presence of a causal relationship between the two phenomena. The alpha radiation-dependent mortality from malignant melanoma of skin for the studied interval for the region reached 50% in 2012 compared to the total mortality from this cause.

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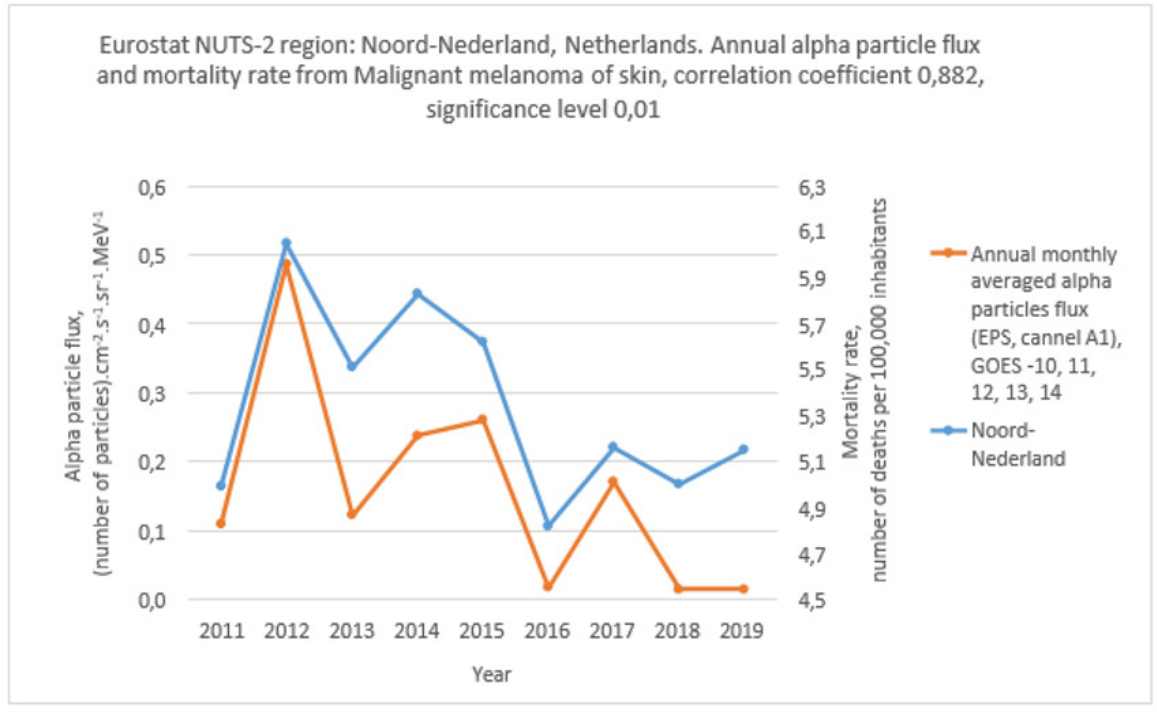

Figure 3: The high statistically significant correlation between annual fluxes of cosmic alpha radiation and the "Malignant melanoma of skin" mortality rate for the EUROSTAT NUTS-2 region NOORD- NEDERLAND, NETHERLANDS, indicates the presence of a causal relationship between the two phenomena.

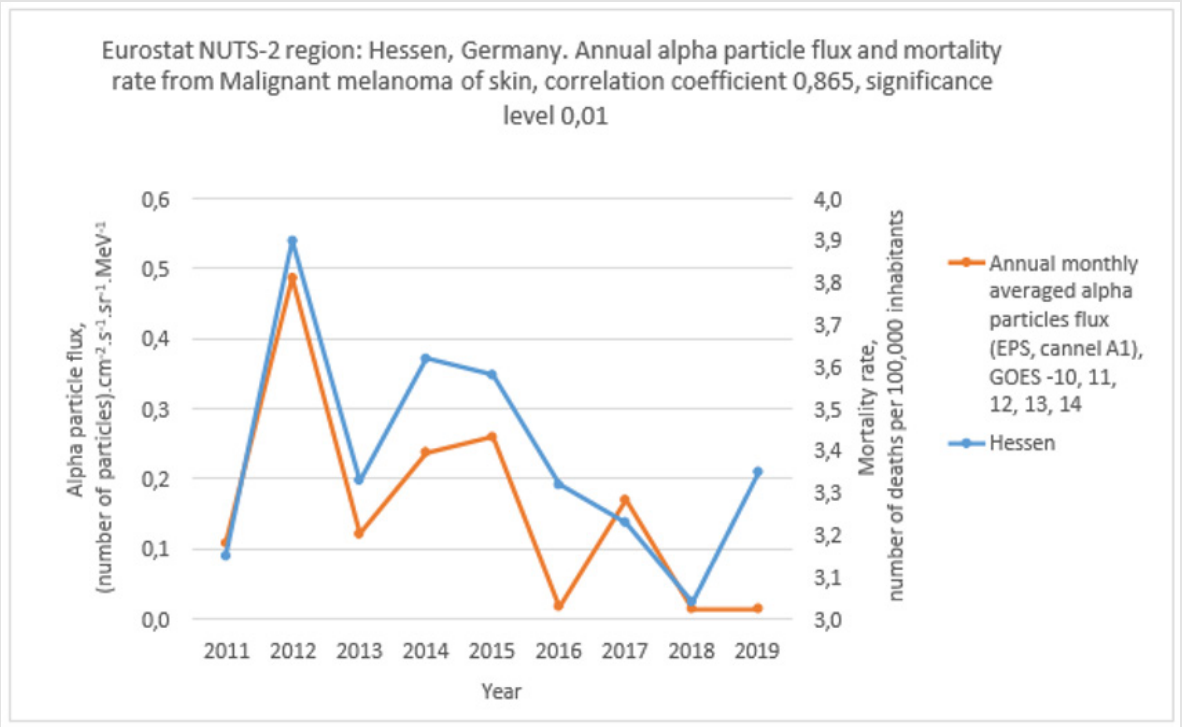

Figure 4: The high statistically significant correlation between annual fluxes of cosmic alpha radiation and the "Malignant melanoma of skin" mortality rate for the EUROSTAT NUTS-2 region HESSEN, GERMANY, indicates the presence of a causal relationship between the two phenomena.

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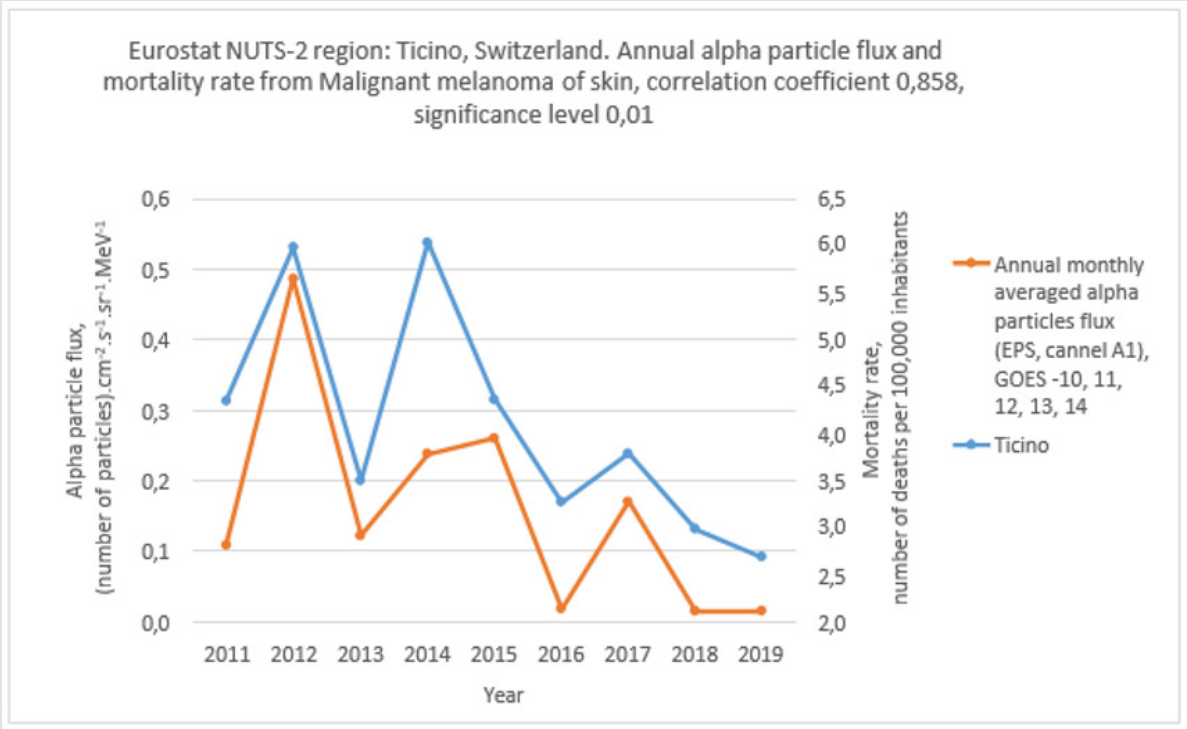

Figure 5: The high statistically significant correlation between annual fluxes of cosmic alpha radiation and the "Malignant melanoma of skin" mortality rate for the EUROSTAT NUTS-2 region TICINO, SWITZERLAND, indicates the presence of a causal relationship between the two phenomena.

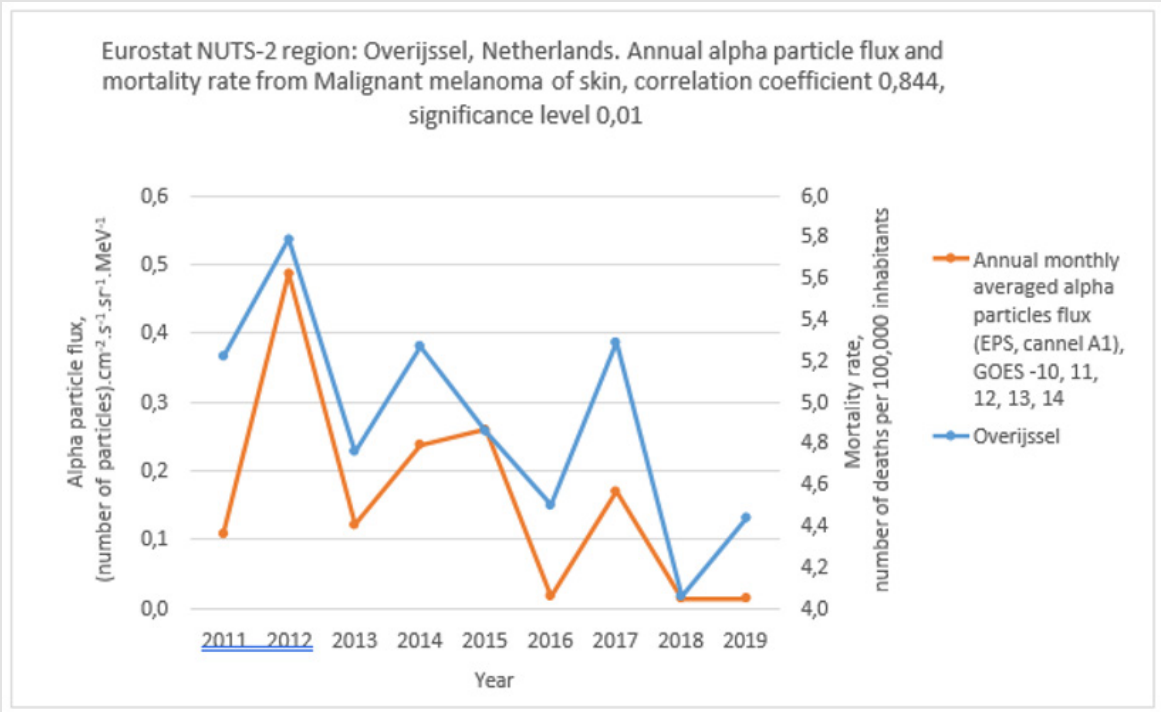

Figure 6: The high statistically significant correlation between annual fluxes of cosmic alpha radiation and the "Malignant melanoma of skin" mortality rate for the EUROSTAT NUTS-2 region OVERIJSSEL, NETHERLANDS, indicates the presence of a causal relationship between the two phenomena.

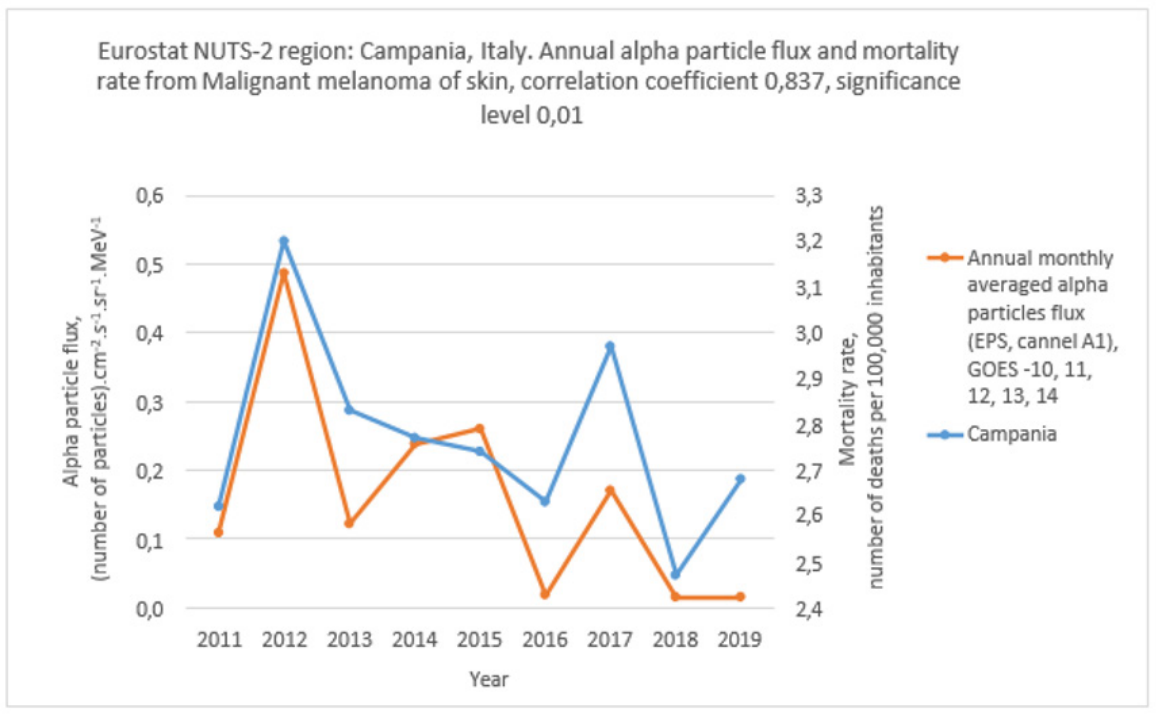

Figure 7: The high statistically significant correlation between annual fluxes of cosmic alpha radiation and the "Malignant melanoma of skin" mortality rate for the EUROSTAT NUTS-2 region CAMPANIA, ITALY, indicates the presence of a causal relationship between the two phenomena.

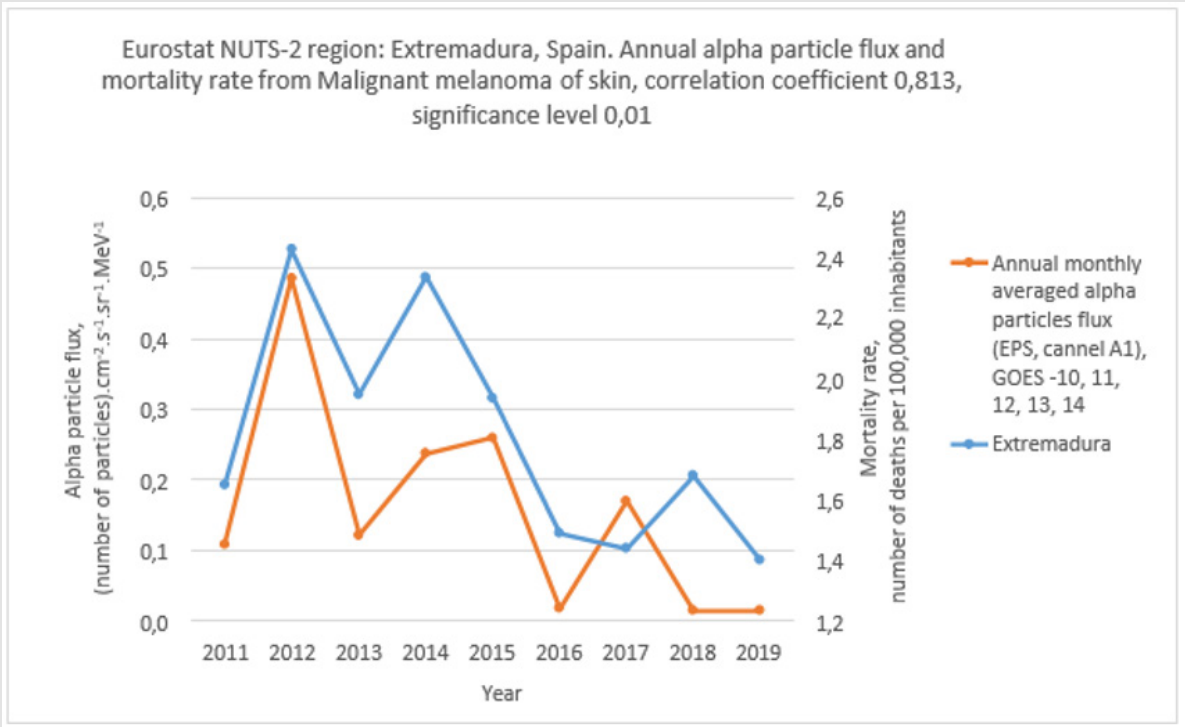

Figure 8: The high statistically significant correlation between annual fluxes of cosmic alpha radiation and the "Malignant melanoma of skin" mortality rate for the EUROSTAT NUTS-2 region EXTREMADURA, SPAIN, indicates the presence of a causal relationship between the two phenomena.

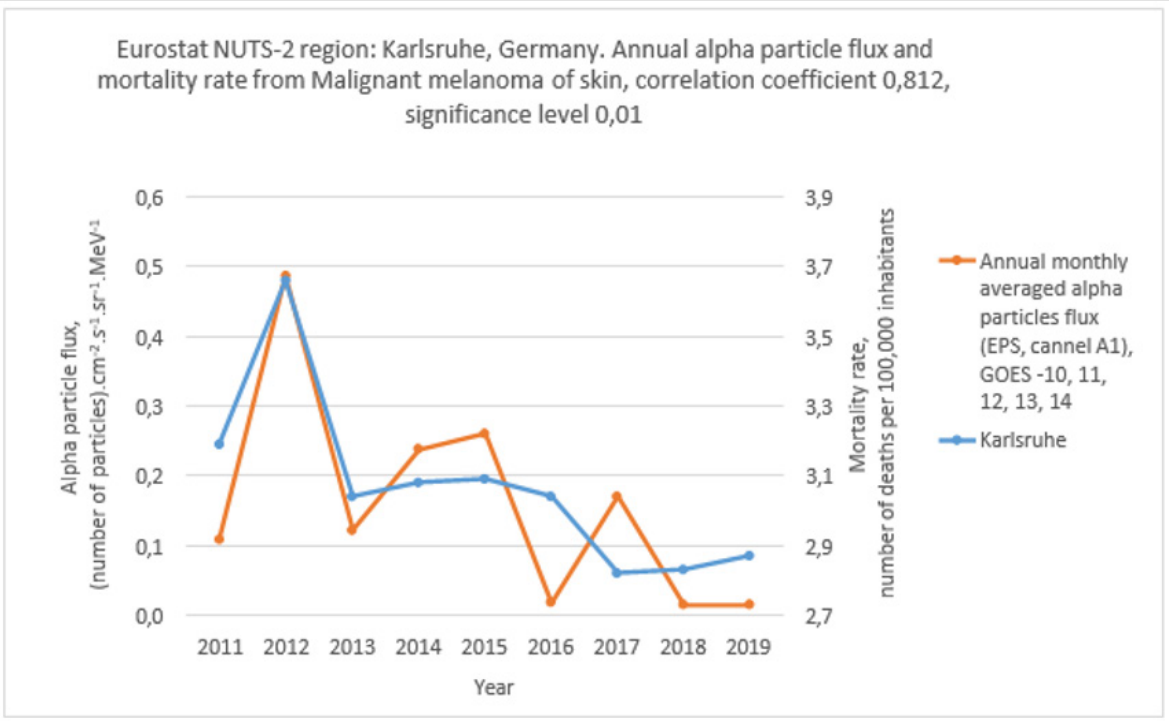

Figure 9: The high statistically significant correlation between annual fluxes of cosmic alpha radiation and the "Malignant melanoma of skin" mortality rate for the EUROSTAT NUTS-2 region KARLSRUHE, GERMANY, indicates the presence of a causal relationship between the two phenomena.

Discussion

The given examples convincingly prove the existence of an influence of cosmic radiation flux on malignant melanoma mortality. The problem of the mechanism of the described influence remains unclear. A hypothesized mechanism of this influence is outlined below, answering many of the questions that arise.

1) An observed phenomenon – mortality from many diseases in the statistics of many countries located mainly in the 30°N – 60°N band, is strongly correlated with fluxes of positively charged particles with energy of the order of 4 – 21 MeV, recorded by the GOES series satellites in Earth orbit.

2) The recorded alpha particle flows are mostly pulses with a duration of less than 5 minutes (the averaging interval of the recording device).

3) Proposed hypothesis – positively charged particles with high energy penetrate through the Earth's atmosphere to the Earth's surface and damage human health, causing death mainly in elderly people.

4) As the average altitude of the affected countries increases, the particle flux- correlated mortality shows an increasing trend [4,10]. It is probably due to the more intense radiation flux penetrating the thinner atmosphere over the mountainous region of Earth's surface – an argument favoring the hypothesis.

5) The source of the flows of positively charged particles is the Sun – mortality increases with observable processes on the Sun – from Solar Mass Ejections directed to Earth (a phenomenon on the solar surface that could be observed with other astronomical means) [4,8]. The Alpha Magnetic Spectrometer (AMS-02) on the International Space Station measures cosmic rays, excluding those of solar origin (when shielded from the Sun by the station's solar panels). In particular, it measures the flow of 3He and 4He (alpha particles) in cosmic rays. The measurements show [31] increasing annual flux of alpha particles in cosmic rays for the interval of years from 2011 to 2017 (last available data), while the flux of GOES registered (solar?) alpha particles for the same interval of years is decreasing (Figures 2-9). Indirect evidence for the Sun as a source of high-energy alpha particles is that this assumption convincingly explains the downstream processes that ultimately lead to death.

6) Positively charged solar particles capable of penetrating through the Earth's atmosphere to the Earth's surface are high-energy alpha particles. Calculators PSTAR

[28] and ASTAR [29] calculate the penetration parameters of protons, respectively alpha particles in different substances, in particular in air. Calculations with data for a homogeneous atmosphere – an atmospheric model with constant density, temperature, and pressure decreasing with height [4] show that only particles whose energy is above 2.4 GeV for protons and over 6.2 GeV for alpha particles can penetrate the Earth's atmosphere to the surface. There are no registered by GOES satellites protons above 0.7 GeV, but there are registered alpha particles with energy above 3.4 GeV, hypothetically also those with energy above 6.2 GeV [4,10,12], i.e. the particles that penetrate to the Earth's surface are probably high-energy alpha particles. Only fluxes of alpha particles with a magnitude of at least (1000 particles).cm 2. s-1. MeV-1 is correlated with the mortality of the Earth's surface.

7) It is assumed that the alpha particles recorded by the satellites were emitted simultaneously with the hypothetical fast alpha particles in a common explosive process (flares?) on the solar surface. It can be calculated that particles with an energy of 7 GeV need 8.87 min to reach the Earth's surface from the Sun's surface and registered by satellites particles with energies of 5 – 10 MeV travel about 2 hours. The registered alpha particles do not have enough energy to penetrate the atmosphere, unlike the hypothetical Fast alpha particles that reach the surface of the Earth in minutes from the center of the solar disk. However, the registered alpha particles are an indicator that two hours earlier there was an irradiation of the Earth's surface with fast (unregistered) alpha particles.

8) Although alpha particle streams irradiate the entire illuminated part of the atmosphere, penetration of fast alpha particles to the surface occurs only in a limited area of the surface (death spot), for which two conditions favoring penetration are combined:

a) The Sun is culminating for the center of the death spot,

b) For the center of the death spot, a coincidence is in effect – the direction of the geomagnetic vector coincides with the direction of the alpha particle intrusion – the alpha particle movement is not affected by the deflecting magnetic force. Such a coincidence occurs twice a year for latitudes in the band from 28°N to 48°N [4]. For latitudes outside this band, such a coincidence is impossible, the fast alpha particles do not reach the Earth's surface, or their flux on the surface decreases fast with their moving away from the band.

9) During the year, the apparent position of the Sun relative to the point of observation shifts, so that the maximum angle of elevation of the Sun's disk above the horizon (solar culmination) changes depending on the date.

The latitude and longitude of a point on the Earth's surface where the solar disk is at its culmination at that moment of registration of the incoming alpha particle flow – the point of registration, can be determined from the date (latitude), and the hours and minutes of registration (longitude). The center of the dead spot can be calculated – it is approximately 30° east of the registration point [10]. The Earth's angular velocity is 15° per hour. The moment of occurrence of a flow of fast alpha particles cannot be predicted, but the dates of increased risk for a given point on the Earth's surface between 30°N – 50°N can be calculated by the latitude of the location [10]. For example, for the EUROSTAT NUTS-2 region Vorarlberg, Austria See (Figure 2), with latitude 47°N, the dates with maximum risk are around May 24 and July 20. On these dates, the inclination (63.6°) of the geomagnetic vector for Austria is close in magnitude to or coincides with the culmination of the Sun (the Earth's atmosphere is thinnest at the moment of the Sun's culmination, and there is no deflecting magnetic force for alpha particles if they intrude at this time from the Sun). The increased risk of health incidents outdoors around local noon is a further argument for the healthfulness of the indoor midday break ('siesta') practiced in Mediterranean countries. The arguments given above reveal a new, previously unsuspected cosmic cause of melanoma mortality – solar corpuscular alpha radiation. This type of radiation may be the leading external cause of melanoma disease. The risk, in particular for melanoma, is highest for inhabitants in the mountainous regions, in ours around local noon.

The risk is also increased during certain days of the year (depending on the latitude of the observation point) during which the solar culmination coincides with the angle of the geomagnetic vector (inclination). If a stream of high-energy solar alpha particles were to hit the Earth at this time, there would be no deflecting magnetic force on them, making it easier for them to reach the Earth's surface. The predominant part of the recorded pulses of alpha particles forms unnatural series with fixed periods and relatively constant magnitudes, which allows the hypothesis of their artificial origin [12]. The creams and oils that are used to protect the skin from ultraviolet radiation are useless in protecting the human body from the penetration of alpha particles with high enough energy, capable of overcoming the resistance of the atmosphere and reaching the Earth's surface. The predominant part of the recorded pulses of alpha particles forms unnatural series with fixed periods and relatively constant magnitudes, which allows the hypothesis of their artificial origin [12].

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