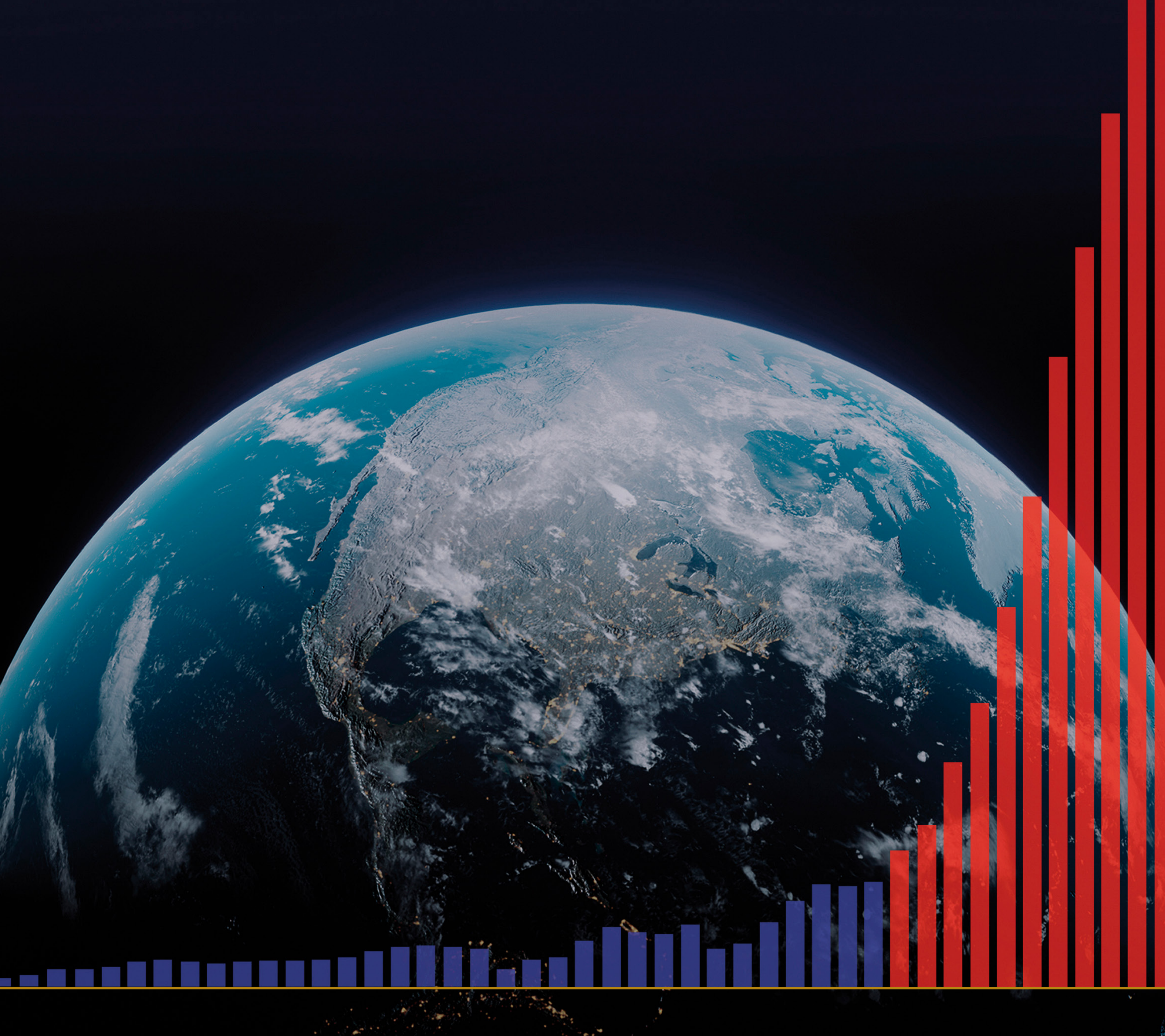
Report

ON THE PROGRESSION

OF **CLIMATIC DISASTERS** ON EARTH AND THEIR **CATASTROPHIC CONSEQUENCES**



ON THE PROGRESSION

OF **CLIMATIC DISASTERS** ON EARTH AND THEIR **CATASTROPHIC CONSEQUENCES**

Report

CONTENTS

Part 1

EXPONENTIAL GROWTH OF NATURAL DISASTERS

According to the latest scientific research, there is a probability that by 2036, the viability of Earth's biosphere could be threatened. This assumption is based on rigorous mathematical models and factual data that indicate a possible critical state of the planet. The anthropogenic factor – human activities that lead to an increase in the concentration of greenhouse gases in the atmosphere – play a significant role in climate change. Besides anthropogenic impact, there are other, often underestimated factors that significantly influence climate changes. These include natural cycles in geodynamics, as well as astronomical processes, including solar activity and Earth's orbital variations. These factors play a key role in long-term climate cycles and can either amplify or mitigate the anthropogenic impact on Earth's climate system.

In recent years, there has been a rapid increase in the number of climatic catastrophes across the planet. Their momentum is characterized by exponential growth. Cataclysms occur suddenly and in places where they have never happened before, while causing massive damages and loss of human lives. In the past, there had been climate and geophysical catastrophes of a larger scale than the ones we've seen over the last ten years, but those were isolated events. Currently, natural disasters exhibit a steady upward trend, synchronous nature, and expanding geographical impact.

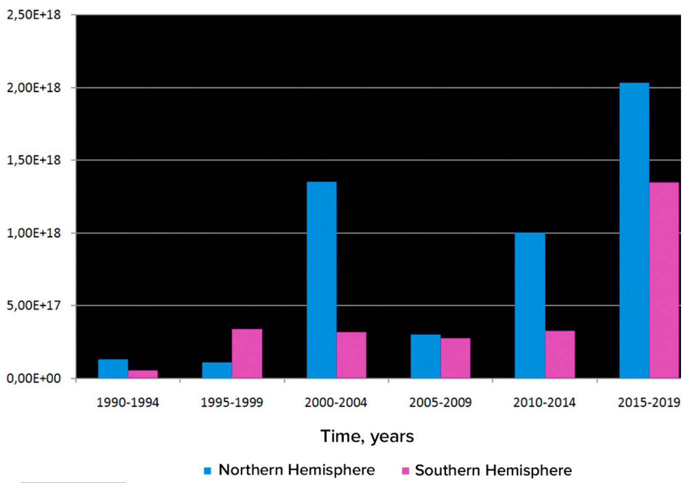
This report presents an analysis of the progression of increasing climatic and geodynamic changes on Earth over the past 30 years, as well as their relationship with additional anthropogenic factors that significantly exacerbate the climate situation on the planet. The report also presents a forecast of exponential growth of cataclysms, indicating the high vulnerability of the United States of America and the Russian Federation, as well as the entire world, to the growing number and strength of extreme natural disasters. All of the analysis presented is based on publicly available scientific data.

Before addressing the new anthropogenic factors in detail, a thorough analysis of the geodynamic changes affecting our planet's lithosphere, hydrosphere, atmosphere, and magnetosphere is necessary. Such an approach will not only outline the overall picture of current climatic changes but also precisely determine how human activities affect these complex and interrelated processes.

Seismic Activity Increase

The Earth is experiencing an abnormal increase in seismic activity: the magnitude, frequency, and energy release of earthquakes are increasing. This trend is noticeable both on continents and on the ocean floor.

According to data from the International Seismological Centre (ISC), there has been a consistent increase in earthquake energy around the planet since 1990 (Figure 1).



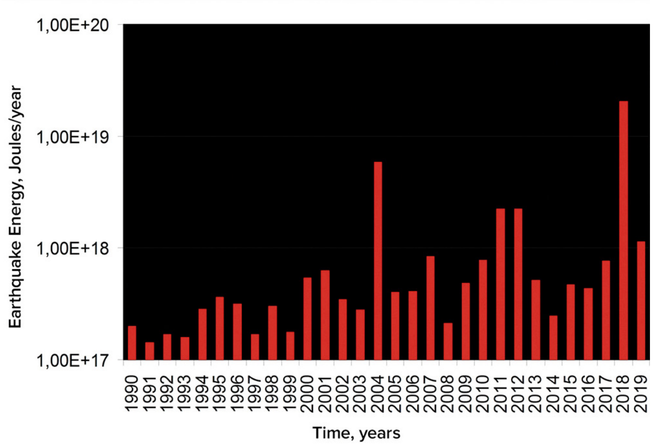
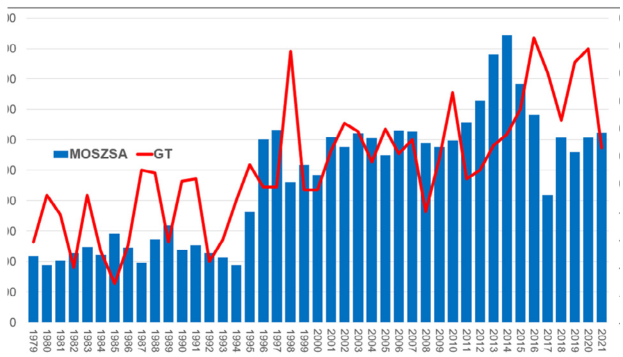


Figure 1

The graphs depict the earthquake energy from 1990 to 2019, based on ISC data. The author of the graphs is Dr. A. Yu. Reteyum, a professor at the Faculty of Geography of Lomonosov Moscow State University, 2020. Source of graphs: https://regnum.ru/article/3101660, https://regnum.ru/article/2913426

Arthur Viterito, a professor at the University of Maryland, has observed an increase in the number of earthquakes on the ocean floor along mid-ocean spreading zones since 1995[1] (Figure 2). Moreover, with a correlation coefficient of 0.7, this graph corresponds to the rise in global temperatures with temperature lagging behind by two years. Seismic and volcanic activity along mid-ocean spreading zones leads to an increase in the rates of hydrothermal vent emissions and heating of the water, which, in turn, leads to the release of greenhouse gases and warming of the atmosphere.



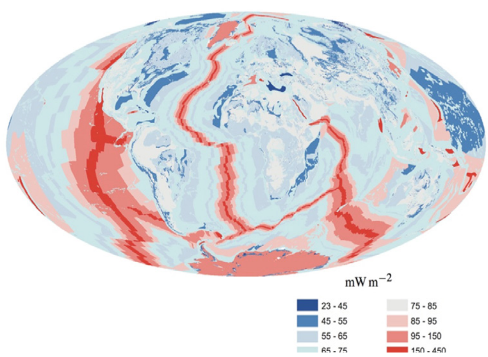


Figure 2

The simultaneous increase in the number of ocean floor earthquakes with magnitudes of 4-6 and global atmospheric temperatures. Viterito, A. (2022) 1995: An Important Inflection Point in Recent Geophysical History. International Journal of Environmental Sciences & Natural Resources, 29(5). https://doi.org/10.19080/ijesnr.2022.29.556271
The map displays the geothermal heating of Mid-Ocean Ridges, Davies & Davies, 2010.

[1] Viterito, A. (2022). 1995: An important inflection point in recent geophysical history. International Journal of Environmental Sciences & Natural Resources, 29(5). https://doi.org/10.19080/

In the modern period, in contrast to historical data, an unprecedented exponential increase in the frequency of significant earthquakes is observed. Data analysis from the US Geological Survey (USGS) indicates that before the 2000s, there were only one or two destructive earthquakes with a magnitude of 6 and above per year, whereas today, their number has increased by eight times (Figure 3).

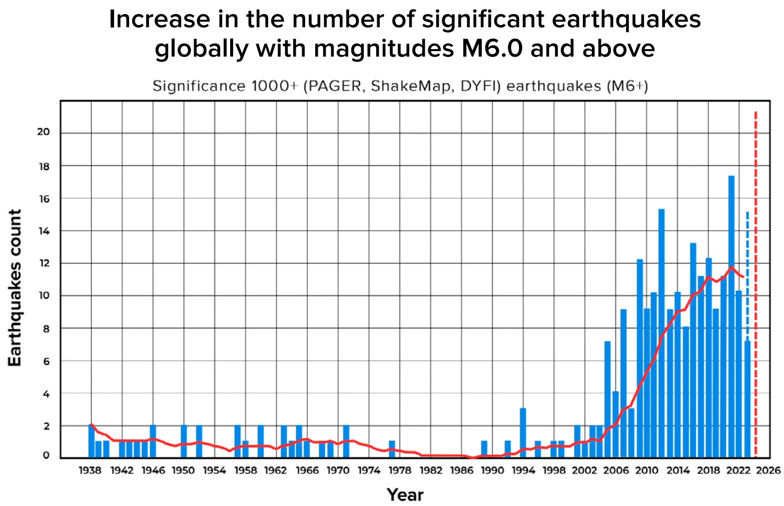


Figure 3

The number of significant earthquakes of M6 and above globally. The selection of earthquakes was carried out based on a significance criterion of 1,000+, considering magnitude, intensity, perceptibility, and damage to identify events with significant consequences, while excluding minor and insignificant cases.
Data source: U.S. Geological Survey (USGS)

The number of earthquakes is increasing in regions previously not known for high seismic activity. The maps presented in Figure 4 clearly demonstrate the expansion of the geographical coverage of seismic events – they now extend beyond the boundaries of lithospheric plates and occur within stable platforms.

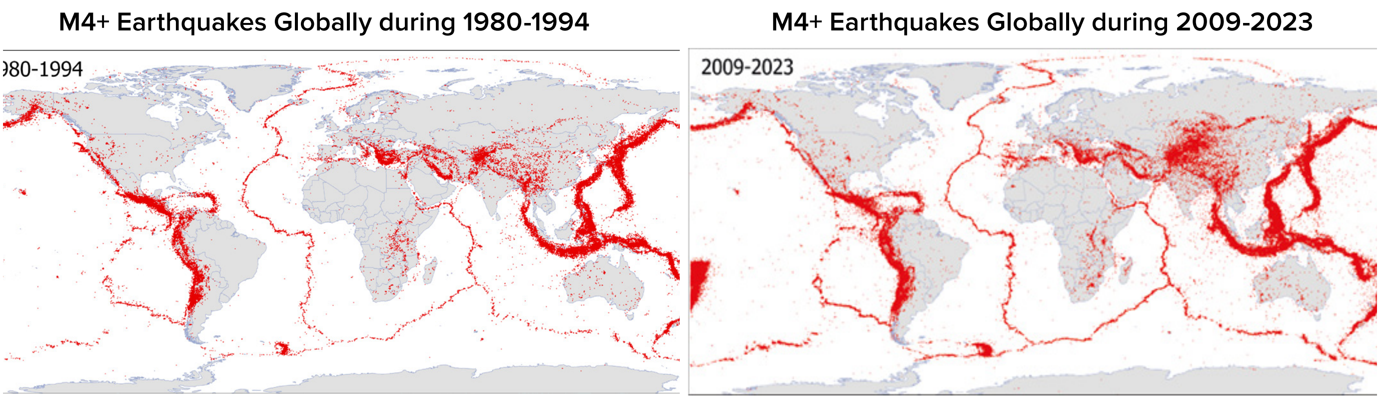


Figure 4

The map displays all earthquakes with a magnitude of 4.0 and above for two identical time periods: 1980–1994 and 2009–2023. The maps were created considering all unique earthquakes recorded in seismic databases such as IRIS, ISC, USGS, EMCS, and VolcanoDiscovery.

Some people believe that the increase in the number of earthquakes is due to the expansion of the seismic sensor network rather than an actual increase in the number of events. Over time, the number and sensitivity of seismic sensors have indeed increased. However, this has only led to more detailed recording of small-magnitude earthquakes that were previously unnoticed. In fact, since the 1970s, there have been enough seismic sensors in place to record all earthquakes with a magnitude of 4.0 or higher (see Figure 5). Therefore, the observed trend of increasing earthquakes since 1995 is not due to technological advancements but reflects real changes. Over the last 25 years, seismic activity has indeed increased dramatically and continues to rise.

Seismic event density chart dependent on magnitude globally

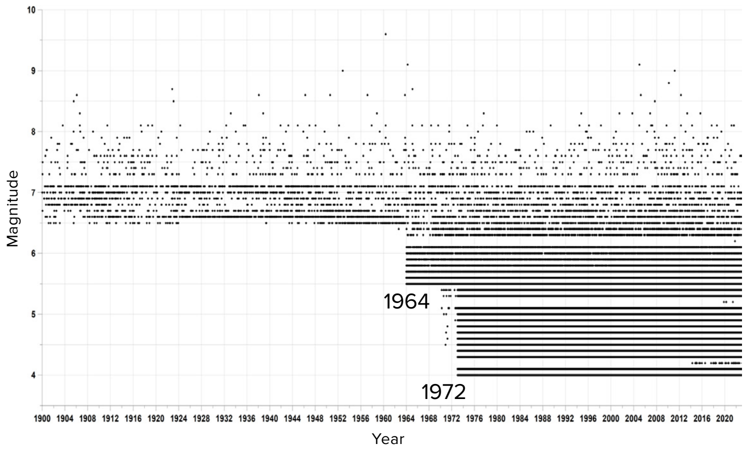


Figure 5

The black dots on the graph represent earthquakes of varying magnitude in different years. Before 1964, only earthquakes with a magnitude of 6.5 and higher were recorded. Since 1964 (with the installation of more sensitive detectors), earthquakes of magnitude 5.5 and higher have been recorded. Since 1972, earthquakes with a magnitude of 4.0 and higher have been recorded, regardless of their location.

The map in Figure 6 displays the spatial distribution of earthquakes with a magnitude of 4.0–4.9 that occurred in different regions of the Earth. These maps account for all unique earthquakes recorded in the seismic databases of IRIS, ISC, USGS, EMCS, and VolcanoDiscovery. The map shows that the seismic events with a magnitude of 4.0–4.9 were already recorded worldwide before 1995, indicating the presence of seismic sensors in these areas. Since 1995, there has been an observed increase in the number and area of regions with high seismic activity, as well as the emergence of new regions with a significant number of earthquakes.

M 4.0–4.9 Earthquakes Globally during 1980-1994 **M4.0–4.9 Earthquakes Globally during 2009-2023**

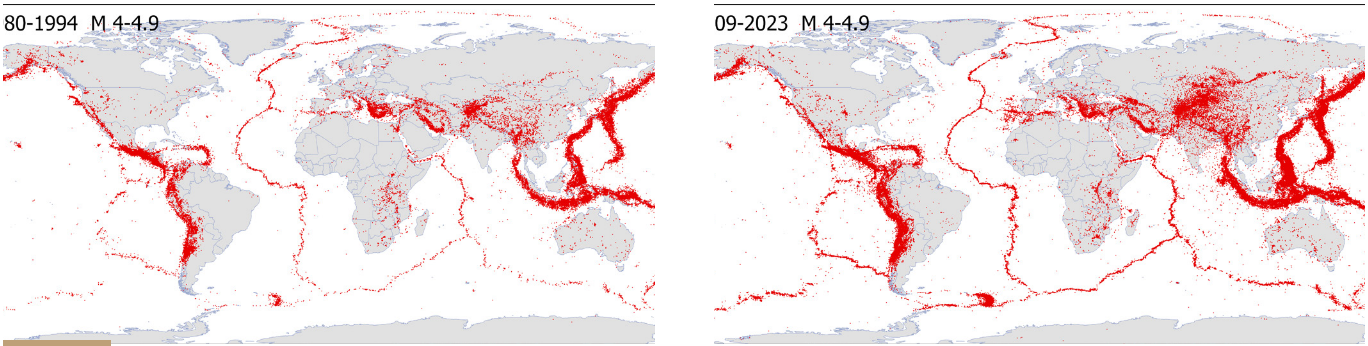


Figure 6

Earthquakes with a magnitude of 4.0-4.9 worldwide for 1980-1994 and 2009-2023. These maps account for all unique earthquakes recorded in the seismic databases of IRIS, ISC, USGS, EMCS, and VolcanoDiscovery.

The increase in earthquakes with a magnitude of 5.0 or higher is also reflected in the graph depicting the number of seismic events according to the International Seismological Centre database (Figure 7).

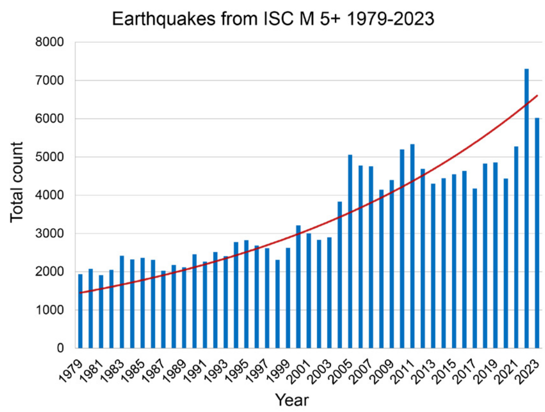


Figure 7

Earthquakes with a magnitude of 5.0 and higher according to the ISC database. The significant increase in the number of earthquakes in 1995 is clearly visible.

According to the VolcanoDiscovery database (https://www.volcanodiscovery.com), in the 1980s, there were around 10,000 earthquakes with a magnitude of 3.0 or higher each year. However, starting from 2021, there have been over 60,000 earthquakes of this magnitude annually (see Figure 8). Notably, this database includes a significant set of seismic events not present in other databases.

The increase in the number of small-magnitude earthquakes suggests that the number of high-magnitude earthquakes will likely rise in the future, according to Gutenberg-Richter's Law. This law expresses a logarithmic relationship between the number of earthquakes and their magnitude, i.e. if the number of small-magnitude earthquakes increases, then the number of large-magnitude earthquakes is also expected to increase.

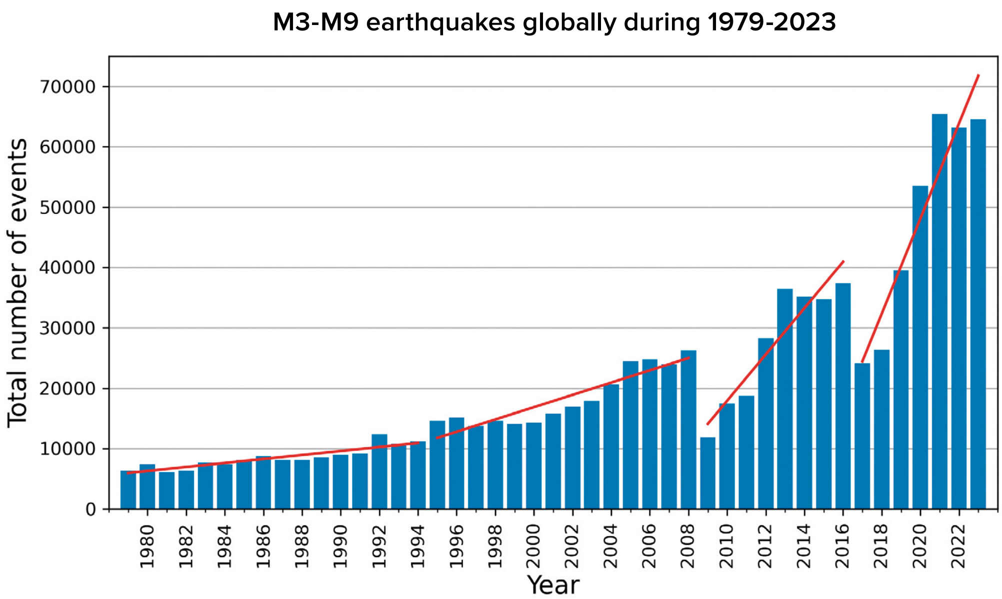


Figure 8

The graph displays the increase in the number of earthquakes with a magnitude of 3.0 or higher worldwide, based on data from the VolcanoDiscovery seismological database. The graph illustrates an exponential trend.

It is important to note that no global seismic databases can provide a complete and precise representation of seismic activity worldwide due to their differences in technical, scientific, and practical aspects of their operations. Figure 9 presents a graph of the number of earthquakes with a magnitude of at least 3.0 recorded by various international seismological services since 1979.

When comparing all the events presented in these seismic databases, it becomes apparent that since 2014, the sets of seismic events have started to differ not only in quantity (see Figure 9) but also in uniqueness (see Figure 10). That means that there are events that are present in one or more databases but are absent in others. Although the earthquake datasets should reflect the same reality.

To obtain a more comprehensive and objective picture of seismic activity worldwide, it is essential to compare and reconcile data from different sources, taking into account their peculiarities and limitations.

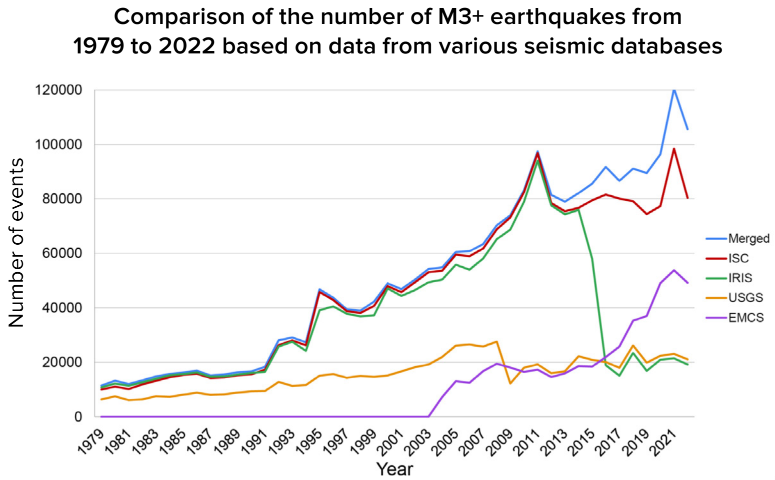


Figure 9

The graph depicts the number of earthquakes with a magnitude of at least 3.0 recorded by various international seismological services over a specific period. The blue curve represents the summation of all unique events gathered from each database. The selection methodology is detailed in Appendix 1.

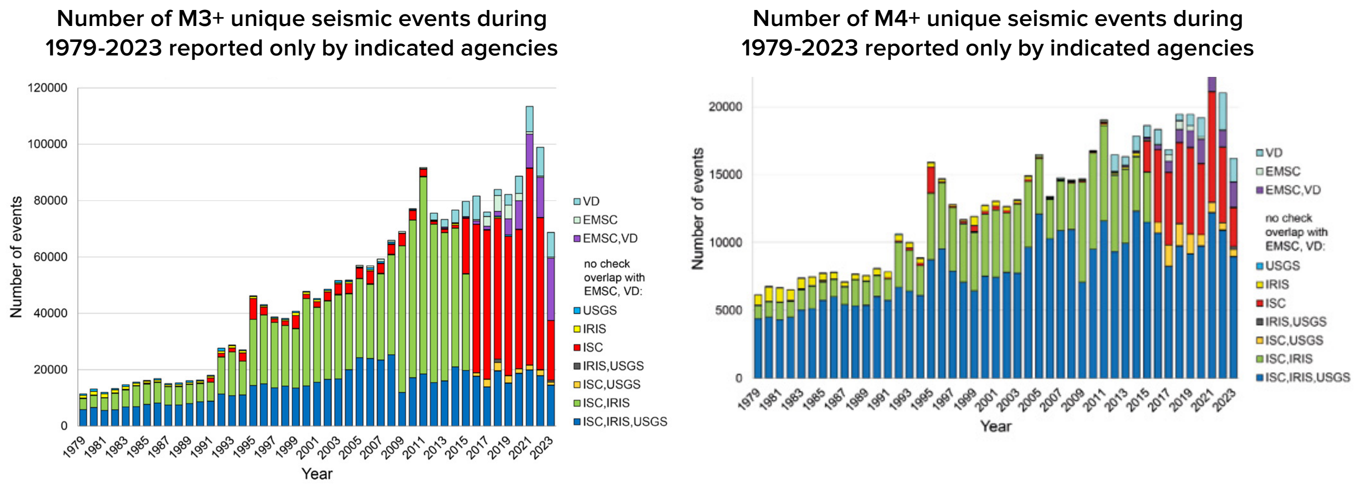


Figure 10

Graphs depicting the number of unique seismic events with a magnitude of 3.0 and above (left) and with a magnitude of 4.0 and above (right) simultaneously present only in the specified seismic services from 1979 to 2023.

Increase in Deep-Focus Earthquakes

Deep-focus earthquakes are seismic events that occur at depths below 300 km and, in some cases, reaching depths of up to 750 km beneath the Earth's surface. Deep-focus earthquakes occur under high pressure and temperature conditions, where the mantle material is expected to deform plastically rather than be brittle and, therefore, should not generate earthquakes. Nevertheless, such events are regularly recorded, and the mechanisms of their occurrence remain the subject of scientific discussions.

The current increase in earthquakes is not attributed solely to the stress in the Earth's crust but rather caused by a rise in global magmatic activity deep within the Earth. This is indicated by the exponential trend of increasing deep-focus earthquakes (Figure 11-12). The graph shows the exponential progression of the increasing number of earthquakes at depths exceeding 300 km in the upper mantle of the Earth. A significant jump can be observed in 1995, similar to jumps in many other geodynamic anomalies.

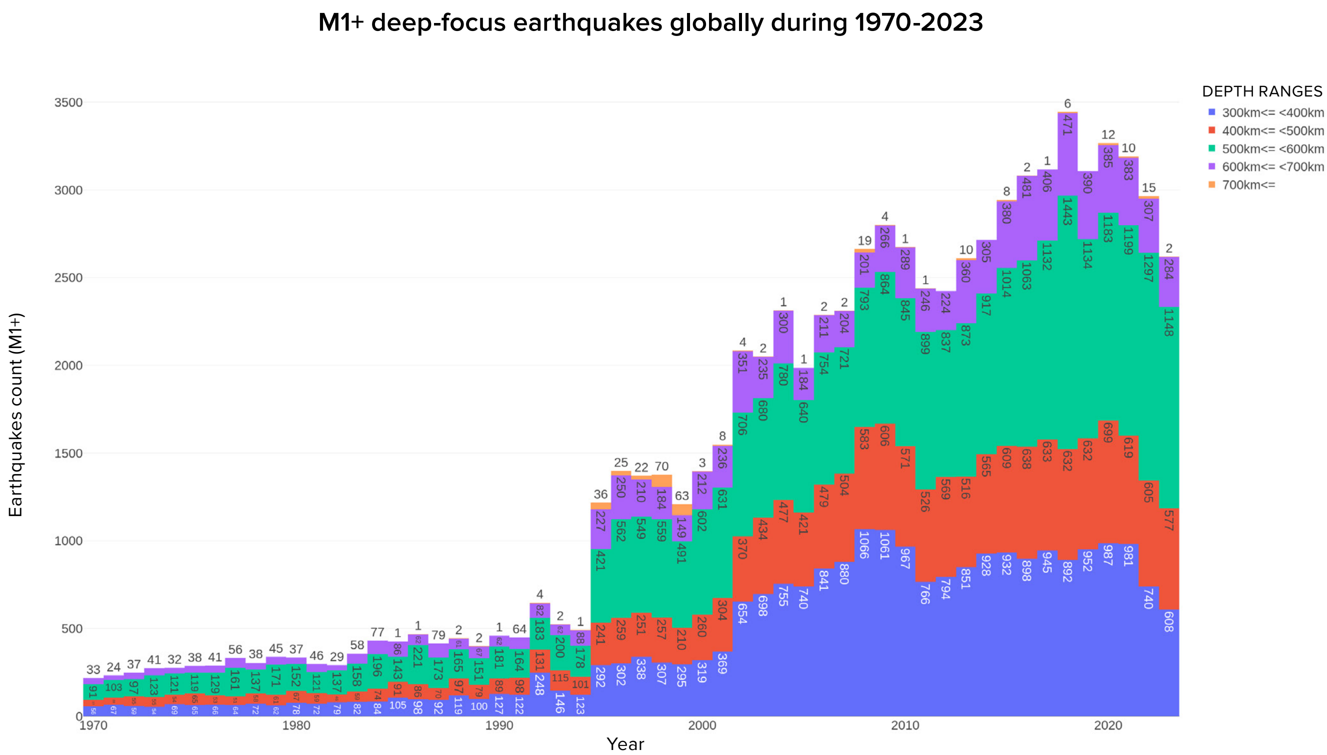


Figure 11

Exponential increase in the number of deep-focus M1+ earthquakes globally since 1970. ISC database.

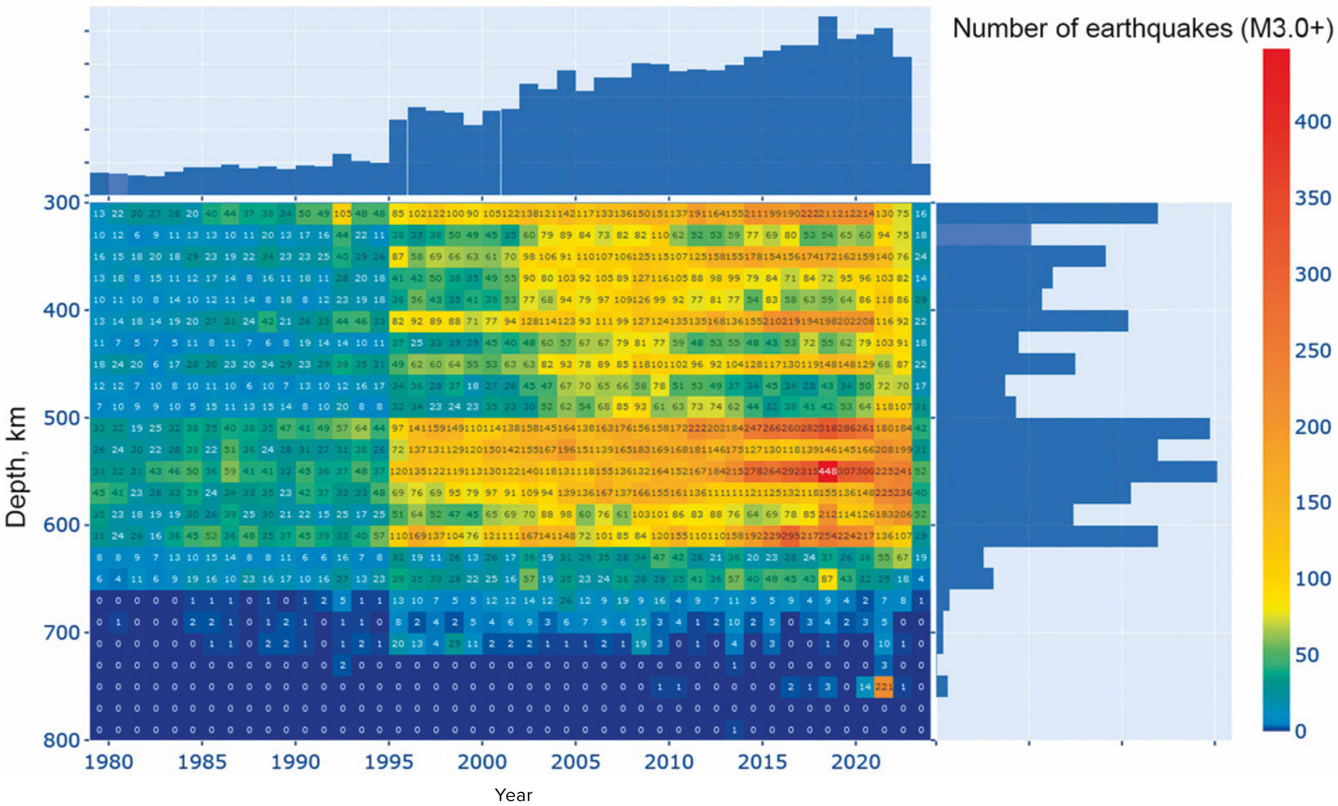


Figure 12

Heat map of deep-focus earthquakes with a magnitude of 3.0 and above. The vertical scale represents the depths of the hypocenters, while the horizontal scale represents the years. ISC database. A notable jump in the number of events can be observed in 1995. The highest number of deep-focus earthquakes occurs at depths within the 500-600 km range.

According to the model described in this report, deep-focus earthquakes represent explosions equivalent in power to a massive number of atomic bombs simultaneously detonating deep within the Earth's mantle. The exponential growth in the number of deep-focus earthquakes indicates extraordinary magmatic activity of our planet. The growing seismic activity in the mantle is of particular concern due to the fact that deep-focus earthquakes often trigger powerful earthquakes within the Earth's crust[2].

[2] Mikhaylova R.S. (2014). Strong earthquakes in the mantle and their impact in the near and far zone. Geophysical Service of the Russian Academy of Sciences.
http://www.emsd.ru/conf2013lib/pdf/seism/Mihaylova.pdf

Mikhailova, R. S., Ulubieva, T. R., & Petrova N. V. (2021). The Hindu Kush Earthquake of October 26, 2015, with Mw=7.5, I0~7: Preceding Seismicity and Aftershock Sequence. Earthquakes of Northern Eurasia, 24, 324–339. DOI: 10.35540/1818-6254.2021.24.31

Activation of Volcanoes

Many large cities are situated near or even within volcanic calderas. For example, Kagoshima in Japan is located within the Aira Caldera. Naples and Pozzuoli are near the Campi Flegrei caldera in Italy. Furthermore, Germany hosts a massive supervolcano called Laacher See, which has started to show signs of activity in recent years.

The increasing magma activity in the Earth's depths is the primary cause of recent changes. This is supported by the rising number of earthquakes in the vicinity of volcanoes and supervolcanoes, such as Campi Flegrei in Italy (see Figure 13), Taupo in New Zealand (see Figure 14), Yellowstone in the USA (see Figure 15), Mauna Loa in Hawaii (see Figure 16), Trident in Alaska (see Figure 17), and Sakurajima volcano within the caldera of the Aira supervolcano in Japan (see Figure 18).

Campi Flegrei Supervolcano

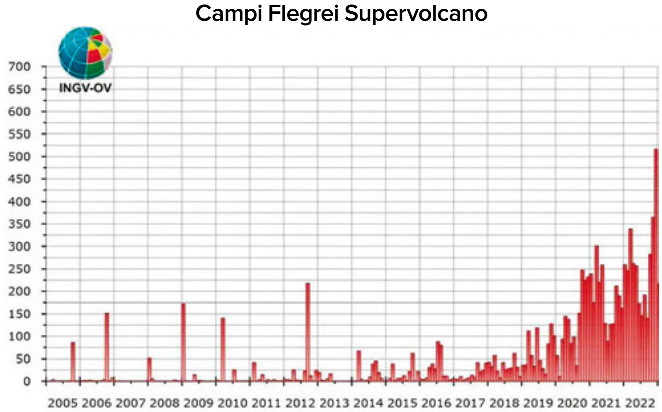


Figure 13

Trend in the frequency of seismic events since 2005, as reported in the Campi Flegrei Bulletin by the Vesuvius Observatory INGV for April 2023. (Source: https://www.fanpage.it/napoli/campi-flegrei-675-terremoti-aprile-2023/)

Taupo Supervolcano

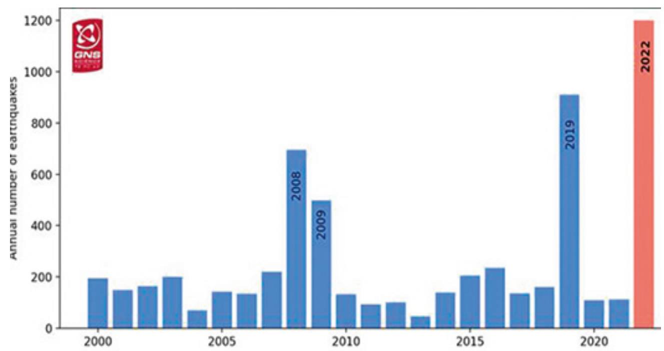


Figure 14

Annual number of earthquakes in the vicinity of the Taupo supervolcano. Data from the GeoNet Volcanic Alert Bulletin. (Retrieved February 14, 2024, from URL https://www.geonet.org.nz/vabs/7tu66IDztDnIaYDG0LYSgl)

Yellowstone Supervolcano

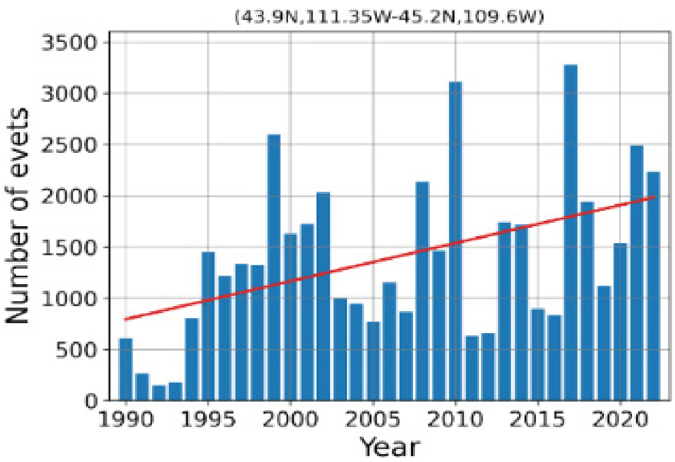


Figure 15

Increase in the annual number of earthquakes in the Yellowstone supervolcano area. Graph based on USGS data.

Mauna Loa Volcano

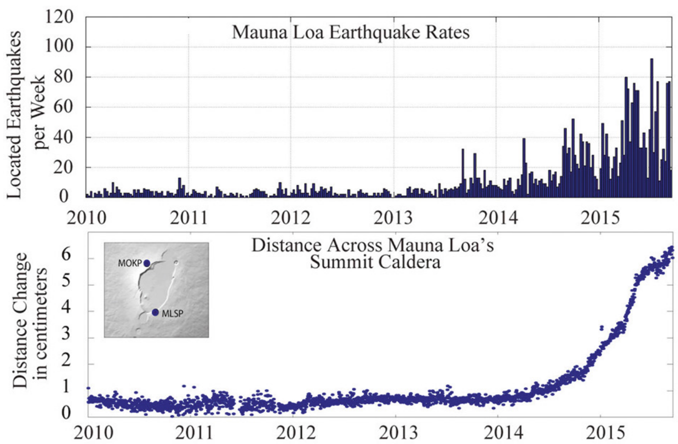


Figure 16

Data on earthquakes and deformations from 2010-2016 in the vicinity of Mauna Loa volcano. Data provided by USGS. (Source: https://www.usgs.gov/media/images/mauna-loa-earthquake-and-deformation-data-2010-2016)

Trident Volcano

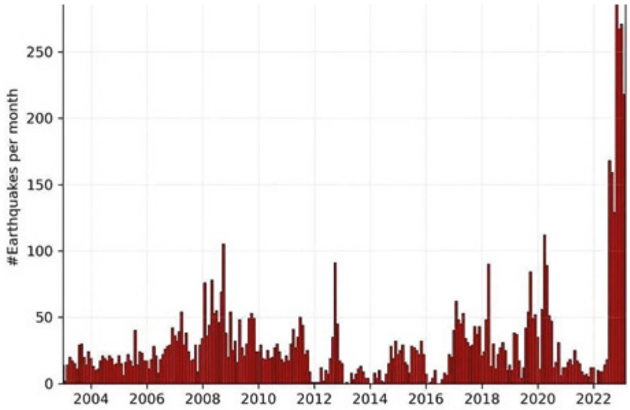


Figure 17

Earthquakes beneath the Trident volcano, Alaska, from January 1, 2003, to February 21, 2023. The histogram displays the number of earthquakes recorded per month. Data source: USGS/AVO, Aaron Wech. (Source: https://watchers.news/2023/02/23/increased-seismic-activity-under-trident-volcano-alaska/)

Sakurajima Volcano

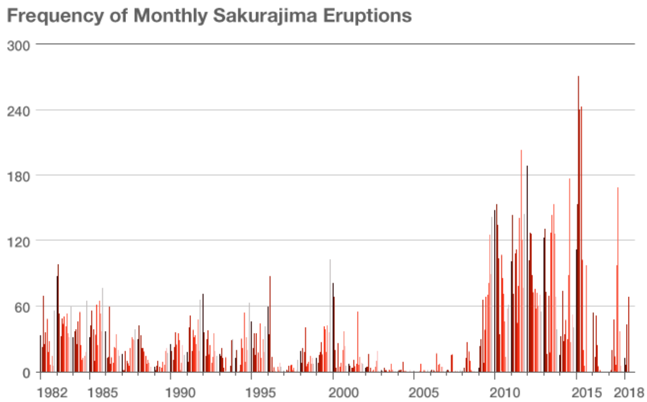


Figure 18

Increase in the number of eruptions indicating rising magma activity at Sakurajima volcano, Japan, within the caldera of the Aira supervolcano. (Source: https://www.nippon.com/en/features/h00194/)

The increasing seismic activity near volcanoes indicates activation of magma processes, suggesting that the volcanic magma chambers are becoming filled and are likely preparing for a potential eruption. Given the current atypical magma activity within our planet's depths, an eruption of one supervolcano could trigger a chain reaction of volcanic explosions, leading to a global catastrophe.

Volcanologists have also noticed another anomaly: the lava ejected by volcanoes has an atypical composition resembling magma from deep mantle layers, which is presented in the following infographic.

The maps display anomalies in the chemical composition or physical properties of lava erupted by various volcanoes over the past 10 years. This data is based on research conducted by scientists from different countries worldwide.

North America

YELLOWSTONE SUPERVOLCANO CALDERA (USA)

SINCE 1995

The frequency and intensity of earthquakes have increased since 1995.

The depth of most earthquakes decreased from 11 km in 2010 to 5 km in 2022.

In 2018 there was a synchronization of geyser activity, when most of the geysers in the entire caldera began to erupt at the same time, many times more frequently. Geyser activity remains high to this day.

https://doi.org/10.1073/pnas.2020943118

In 2013-2014, the rate of uplift suddenly increased by 5 times.

https://doi.org/10.1029/2019JB018208

Local areas of surface overheating have been appearing since 2003.

https://www.usgs.gov/news/thermal-activity-norris-geyser-basin-provides-opportunity-study-hydrothermal-system
https://doi.org/10.3389/feart.2020.00204

North America

EDGECUMBE VOLCANO, ALASKA (USA)

2019-2022

A volcano that has been dormant for 800 years has the fastest rate of ground uplift in Alaska. This is anomalous because dormant volcanoes reactivate dramatically, especially at this rate. Magma is rising about 10 kilometers from a depth of about 20 kilometers, causing earthquakes and significant surface deformation.

https://doi.org/10.1029/2022GL099464

South America

CHAITEN VOLCANO (CHILE)

MAY 1, 2008

The Chaiten volcano suddenly erupted rhyolitic magma. Residents felt earthquakes 24 hours before ash fell on them and a massive eruption occurred. Such a short warning of a major eruption, especially of basalt, is unusual for acid magmas. The rapid resurfacing suggests a transit time of about four hours from a storage depth of more than five kilometers to the near surface. This suggests rapid magma ascent through the sub-volcanic system.

https://doi.org/10.1038/nature08458

Africa

AN UNDERWATER VOLCANO NEAR THE ISLAND OF MAYOTTE (FRANCE)

2019

The birth of a new volcano off the coast of Mayotte, near the island of Reunion, off the coast of Madagascar. In one year, magma traveled 80 km from the Earth's mantle to the surface through the entire Earth's crust, creating a new underwater volcano. This is an unprecedentedly fast rate of volcano formation. In 2019, it was the largest active underwater eruption ever recorded.

https://doi.org/10.1029/2022GL099464

Antarctica

ORCA UNDERWATER VOLCANO IN BRANSFIELD STRAIT

AUGUST 2020 TO FEBRUARY 2021

The area around the previously inactive Orca underwater volcano has experienced around 85,000 earthquakes caused by magma intrusion. The magma burned through 10 kilometers of the Earth's crust in six months, a record for the speed and intensity of the intrusion.

https://doi.org/10.1038/s43247-022-00418-5

Africa

NYIRAGONGO VOLCANO (CONGO-RWANDA)

2021

An eruption without any precursors was caused by the rupture of the edifice of the Nyiragongo volcano. The eruption was anomalous in that it propagated from top to bottom and caused the emplacement of an extensive dyke 25 kilometers long.

https://doi.org/10.1038/s41586-022-05047-8

Antarctica

DECEPTION VOLCANO

2015

Earthquake swarms caused by deep, prolonged and large-scale magma intrusion. Largest activity ever recorded.

https://doi.org/10.1016/j.jvolgeores.2021.107376

Asia

CHANGBAISHAN VOLCANO (NORTH KOREA-CHINA)

2002-2005

A strong deep-focus earthquake near the volcano at a depth of 566 km with a magnitude of 7.2 caused three years of seismic disturbance. Intense earthquake swarms were triggered by the introduction of new magma and gas-phase activity from the mantle.

https://doi.org/10.3389/feart.2020.599329

Asia

RAIKOKE VOLCANO, GREATER KURIL RIDGE (RUSSIA)

JUNE 21-25, 2019

The eruption was one of the largest in the Kuril Islands in the 21st century. The eruption was characterized by an anomaly — the magmas feeding Raikoke Volcano originated in the mantle, i.e. the magmas have a deep source. The eruption was explosive throughout, producing ash falls and pyroclastic density flows. The latter increased the area of the island by 0.7 km^2.

https://doi.org/10.1016/j.jvolgeores.2021.107346

Asia

MOUNT MERAPI VOLCANO (INDONESIA)

2010

The VEI 4 eruption was the worst volcanic disaster to hit Mount Merapi in 80 years. The eruption was triggered by a larger than normal inflow of deep, volatile-rich magma that intruded in a relatively short time. During and after the eruption, lahars overwhelmed almost all major valleys, causing significantly more damage than after previous eruptions.

https://doi.org/10.1007/978-3-031-15040-1_12

Australia, New Zealand and Oceania

CALDERA OF THE TAUPO SUPERVOLCANO (NEW ZEALAND)

2003-2011

Ground uplift has been observed, correlating with intense seismic activity in the region. The birth of a new magma chamber.

https://doi.org/10.1126/sciadv.1600288

2019

A series of earthquakes triggered by magma intrusion at a depth of 8 km within the Taupo caldera.

https://doi.org/10.3389/feart.2020.606992

2022

Increased seismic activity, increased volcanic activity.

https://www.geonet.org.nz/news/LuzOzD-mQcQUUmdeiL67oX

Australia, New Zealand and Oceania

KILAUEA VOLCANO HAWAII (USA)

2018

Largest eruption of the Lower East Rift Zone and caldera collapse for at least 200 years.

https://doi.org/10.1126/science.aav7046

Australia, New Zealand and Oceania

HUNGA TONGA-HUNGA HA'APAI VOLCANO (KINGDOM OF TONGA)

JANUARY 15, 2022

This is the record for the most violent volcanic eruption ever recorded. The plume from this explosive eruption rose to 58 kilometers at its highest point, breaking through the mesosphere. The eruption also produced the highest number of lightning strikes recorded for any natural phenomenon. Lava of a similar composition had not flowed in Tonga's previous eruptions in 2009 and 2014.

In the previous eruptions, the magma was trapped in an intermediate epicenter, but this time the fresh magma rose quickly and wasted no time in changing chemically.

https://doi.org/10.1038/d41586-022-00394-y

https://www.xweather.com/annual-lightning-report

https://doi.org/10.1126/sciadv.adh3156

Europe

FAGRADALSFJALL VOLCANO (ICELAND)

2021

The rate of change in key chemical parameters of the volcano's lava was more than a thousand times faster than in other eruptions. The overall range of chemical compositions from this single event is similar to all eruptions in southwest Iceland over the past 10,000 years. In addition, the phase of the outpouring of the deep magma corresponds to the period of the eruption, when a fountain of lava rose up to 400 meters in height. Geochemical analyses of the basalts outpured during the first 50 days of the eruption, together with associated gas emissions, indicate a direct origin from the magma storage zone in the upper mantle. The Fagradalsfjall volcanic system on the Reykjanes peninsula has erupted three times since 2021 after more than 800 years of dormancy.

https://doi.org/10.1038/s41586-022-04981-x

Europe

BORGARHRAUN VOLCANO (ICELAND)

2014

Unprecedented speed of magma rise in a volcano that had been dormant for a millenia. It took only 10 days for the magma to rise from the reservoir at a depth of 24 km to the surface.

https://doi.org/10.1038/s41561-019-0376-9

Europe

CUMBRE VIEJA VOLCANO (SPAIN)

2021

After the first explosion, mobile, active magma flowed within a few hours. The lava was superfluid, the most liquid of the historic basalt eruptions here. The volcano is fed by melt from the mantle plume, which means it comes from the deep mantle. Perhaps magma was coming from the deeper layers of the Earth, from the core through zones of reduced velocity. This is why the lava that poured to the surface in the September 2021 eruption is superfluid and mobile.

https://doi.org/10.1038/s41598-022-21818-9

Europe

LAACHER SEE SUPERVOLCANO (GERMANY)

2013-2018

The occurrence of seismic activity at depths of 10 to 40 kilometers near the caldera of a supervolcano that erupted 12.9 thousand years ago, as well as continuous volcanic gas emissions around the caldera, indicate an active magmatic system, possibly associated with the upper mantle melting zone.

https://doi.org/10.1093/gji/ggy532

Europe

CALDERA OF CAMPI FLEGREI SUPERVOLCANO (ITALY)

2004-2024

Gas pressure begins to lift the ground, indicating that the volcano is becoming active. Bradyseism continues to this day.

2016-2024

Exponential increase in volcano-tectonic earthquakes and synchronization of all eruption precursors.

https://doi.org/10.1038/s43247-023-00842-1

Europe

ETNA VOLCANO (ITALY)

DECEMBER 2020 - FEBRUARY 2022

The 2020-2022 eruptions were fuelled by the most intense magma ascent of any eruption in the last decade. This period was characterized by more frequent eruptions. Basaltic magma was found to migrate rapidly from the deepest level in record time.

https://doi.org/10.1016/j.earscirev.2023.104563

Europe

UNDERWATER VOLCANO COLUMBO (GREECE)

2006-2007

Frequent upwelling of the main melt from deeper levels leads to heating and formation of a new magma chamber. Records of seismic activity at different times indicate continuous replenishment of the reservoir with magma from deeper sources.

https://doi.org/10.1029/2022GC010420

https://doi.org/10.1029/2022GC010475

In the last decade, there has been an acceleration in the rise of magma from the depths of the Earth's crust in many volcanic regions, such as Iceland, Italy, Mayotte Island in the Indian Ocean, La Palma Island (Canary Islands), and others. This indicates an increase in volcanic activity on a global scale.

Volcanologists are very concerned about the rapid increase in the rate at which magma is rising from the depths of the Earth. A process that used to take hundreds or even thousands of years is now happening in as little as six months in some regions. This dramatic acceleration was observed in the Bransfield Strait in 2021, where the ascent of magma from a depth of 10 km was accompanied by 85,000 earthquakes[3]. The crust thickness in this area is approximately 15 km, and the seismic localization indicated that 10 km of the crust had already been eroded by active magma, leaving only 5 km before it would breach to the surface.

The rapid ascent of magma from significant depths indicates the occurrence of dangerous and unprecedented processes within the Earth. The activation of volcanoes suggests that a vast amount of energy has been accumulating deep within the planet's interior, seeking to erupt outward.

Intensification of Hurricanes, Storms, and Tornadoes

In 2023, for the first time in history, a Category 5 tropical cyclone, the highest category in terms of strength, formed in all oceanic basins. Almost every hurricane in this category set records for strength, duration, and rapid intensification compared to hurricanes in the previous years[4].

For example, Hurricane "Otis," which transformed from a regular tropical storm into the most destructive Category 5 hurricane in just 12 hours. Such a disastrous increase in hurricane wind speed is attributed to the anomalous warming of the ocean and the anthropogenic factor, which will be described below. Due to this ocean heating, more moisture is released into the atmosphere.

A significant increase in atmospheric moisture content over the ocean has been recorded since 1995 (Figure 19). The graph indicates the changes in ocean evaporation and air temperature over the ocean from 1975 to 2020. Since 1995, both indicators have shown a consistent increase, signaling the warming of the global ocean and the atmosphere above it. However, before 1995, both indicators were decreasing. It is worth noting that since 1995, significant geodynamic processes have also been observed in the Earth's interior, including the changes, such as: a 3.5-fold increase in the speed of north magnetic pole drift, the shift in the planet's axis of rotation, and an increase in the planet's rotation speed, as well as an increase in the number and strength of earthquakes on the ocean floor and deep-focus earthquakes (to be covered in more details). Thus, the increase in ocean water temperature and evaporation are related both to the anthropogenic factor and to the rise of magma from the mantle, influencing the temperature and circulation of water in the ocean.

[3] Cesca, S., Sugan, M., Rudzinski, Ł., Vajedian, S., Niemz, P., Plank, S., Petersen, G., Deng, Z., Rivalta, E., Vuan, A., Plasencia Linares, M. P., Heimann, S., & Dahm, T. (2022). Massive earthquake swarm driven by magmatic intrusion at the Bransfield Strait, Antarctica. Communications Earth & Environment, 3(1). https://doi.org/10.1038/s43247-022-00418-5

[4] Mersereau, D. (2023, September 9). The Weather Network, A world first, every tropical ocean saw a Category 5 storm in 2023. https://www.theweathernetwork.com/en/news/weather/severe/a-world-first-every-tropical-ocean-saw-a-category-5-hurricane-cyclone-in-2023

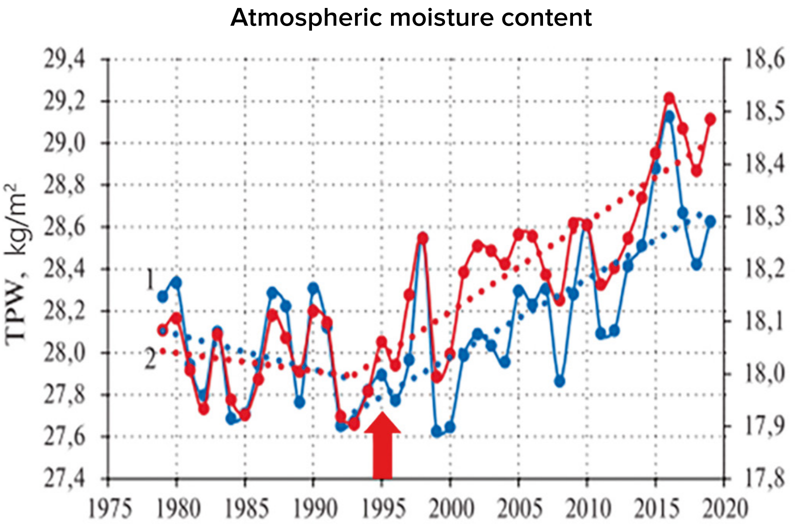


Figure 19

The interannual variation of atmospheric moisture content (1) in kg/m2 and air temperature (2) in °C over the World Ocean from 1979 to 2019.

(Source: Malinin V. N. & Vaynovsky P. A. (2021). Trends of moisture exchange components in the ocean-atmosphere system under global warming conditions", Reanalysis-2. Sovremennye problemy distancionnogo zondirovaniâ Zemli iz kosmosa [Current problems in remote sensing of the Earth from space] 18(3), 9-25. DOI: 10.21046/2070–7401–2021–18–3–9–25)

The increase in air humidity due to ocean evaporation leads to an intensification of hydrometeorological events, such as tropical hurricanes, storms, tornadoes, abnormal temperatures, precipitation, and floods.

In Europe, there is an increasing trend in the number of tornadoes from 1970 to 2023, as depicted in Figure 20, based on data from the European Severe Weather Database (ESWD). There is a significant rise in the number of tornadoes: from approximately 45 tornadoes per year in the 1970s to more than 800 per year from 2014 to 2023. This means that Europe's average number of tornadoes per year has increased 18-fold. Tornadoes and hurricanes are occurring in regions where they have never happened before, resulting in significant economic losses.

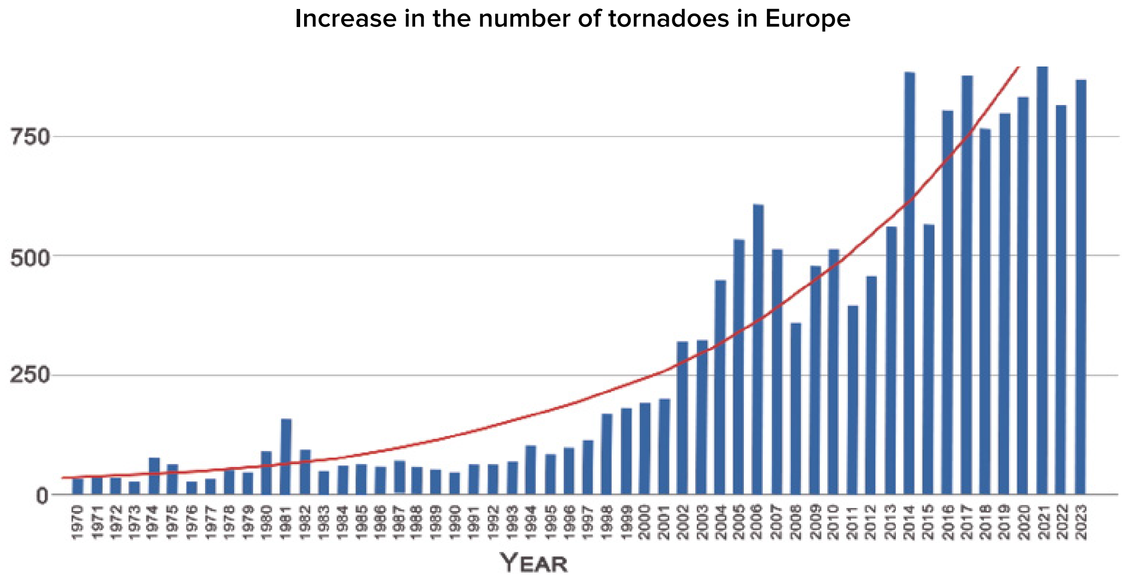


Figure 20

Graph depicting the annual number of tornadoes in Europe. Data source: European Severe Weather Database (ESWD)

In the last decade, convective storms accompanied by tornadoes, hail, heavy rainfall, and thunderstorms have become a predominant phenomenon and caused significant damages in North America and Australia.

An analysis of NOAA data, presented in Figure 21, shows exponential growth in the number of billion-dollar storms in the United States from 1981 to 2023. From 1981 to 1990, there were 2 or less of such storms per year. However, there has been a sharp increase in recent years, with 19 such storms occurring in 2023 alone.

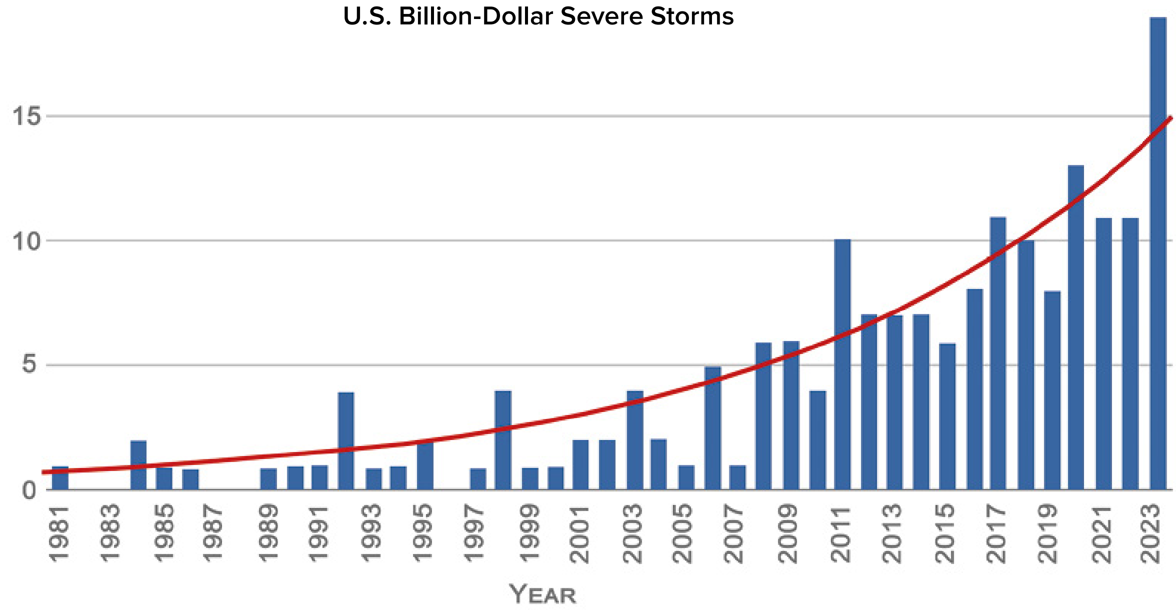


Figure 21

Graph depicting the number of severe storms causing damages exceeding one billion dollars in the United States. Data source: NOAA

The damage from convective storms has become comparable to that from the tropical hurricanes (Figure 22). The main trend visible on the graph is the increase in insurance losses for both categories. This indicates that the cost of these disasters continues to rise.

According to the National Oceanic and Atmospheric Administration (NOAA), over the span of 10 years starting from 1990, convective storms have caused about $40 billion in damage to the United States. However, in the last decade, the total losses increased sixfold, surpassing $240 billion (Figure 23), and in 2023 alone, the storm-related losses set a new record, amounting to $54B.

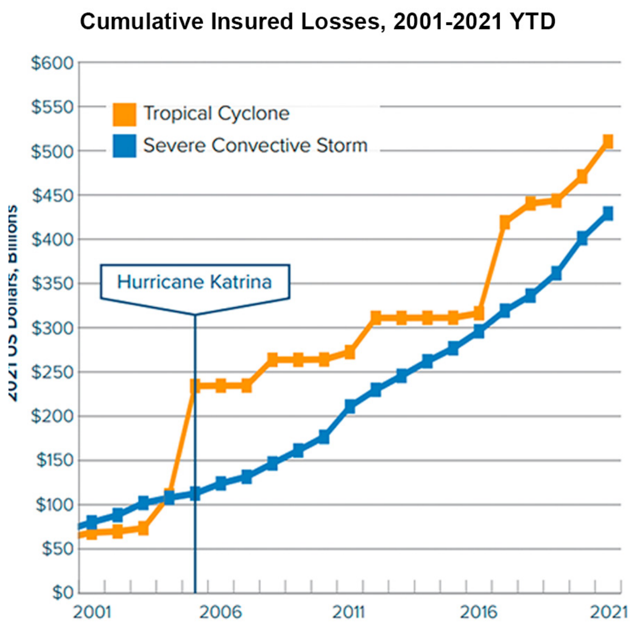


Figure 22

The dynamics of losses from convective storms and tropical hurricanes in the United States from 2001 to 2021. The graph displays two lines: the orange line represents tropical hurricanes, and the blue line represents severe convective storms. Data source: Aon (Catastrophe Insight)

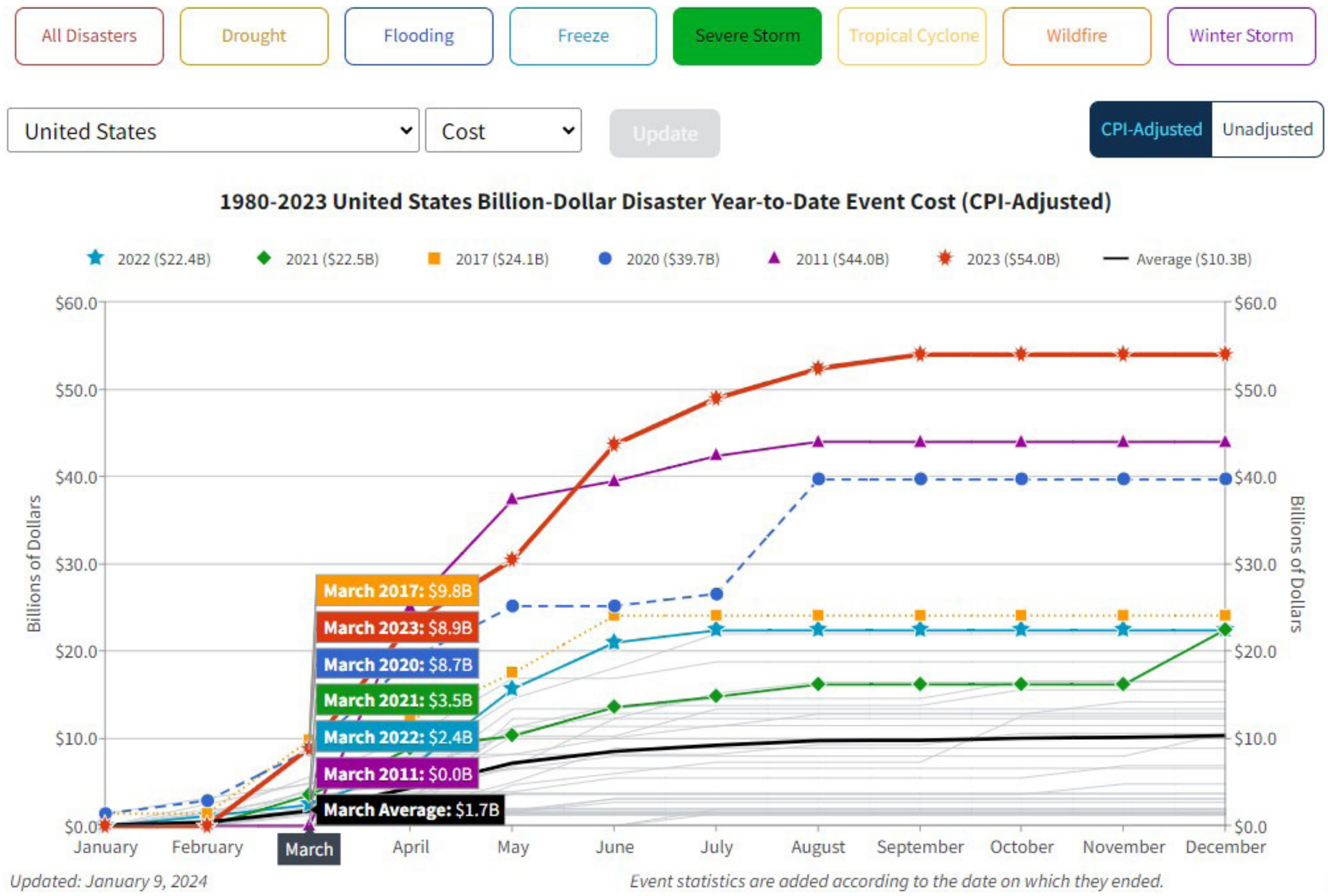


Figure 23

Increase in losses from severe storms exceeding one billion dollars in the United States.
Source: National Oceanic and Atmospheric Administration (NOAA)

NOAA National Centers for Environmental Information (NCEI) U.S. Billion-Dollar Weather and Climate Disasters. (2024). (https://www.ncei.noaa.gov/access/billions/), DOI: 10.25921/stkw-7w73

The graph displays lines of various colors, each representing a specific year. The year 2023, indicated by the red line, experienced the highest damage from severe storms, exceeding 50 billion dollars. The graph covers the period from 1980 to 2023 and is adjusted for inflation (CPI). The graph was last updated on January 9, 2024.

According to AON's report[5] on climate disasters, the most significant economic losses in Europe over the past 10 years were caused by severe convective storms. These storms turned out to be more destructive than winter storms, which were traditionally considered as the primary threat to the region.

According to the Swiss Re Institute's research[6], severe convective storms have recently become the largest source of economic losses among the secondary hazards (high-frequency events with damage ranging from low to medium severity, such as hailstorms, flash floods, tornadoes, landslides, droughts, and wildfires). From 2018 to 2022, economic losses worldwide from severe convective storms amounted to 177 billion USD, representing a 60% increase compared to the previous five years (Figure 24). This indicates a growing frequency and impact from these disasters.

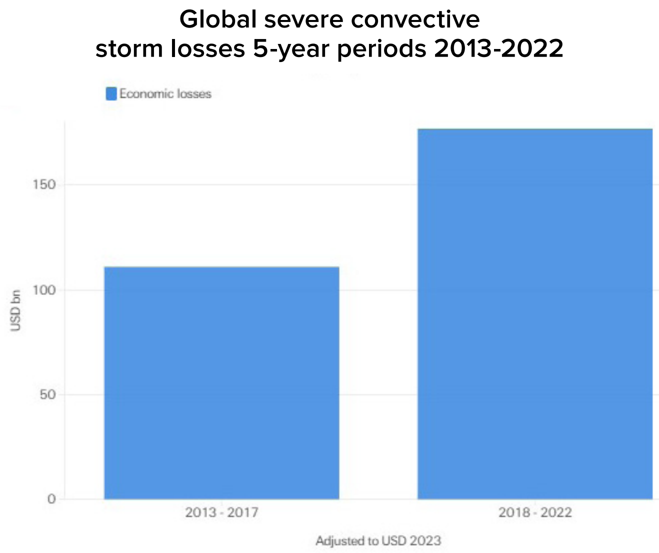


Figure 24

Comparison of global economic losses from convective storms for two five-year periods: 2013-2017 and 2018-2022. Based on Swiss Re Institute data

[5] Weather, Climate and Catastrophe Insight. (2023). (Source: https://www.aon.com/getmedia/f34ec133-3175-406c-9e0b-25cea768c5cf/20230125-weather-climate-catastrophe-insight.pdf, p.42)

[6] Swiss Re Institute. Natural catastrophes in focus: Tornados, hail and thunderstorms. (Source: https://www.swissre.com/risk-knowledge/mitigating-climate-risk/tornados-hail-thunderstorms.html)

Increase in the Number of Floods and Droughts

There has also been a significant increase in the number of severe floods around the world (Figure 25). Severe floods are defined as those that cause significant harm to both people and infrastructure. While in the 1970s, there were only 260 severe floods over a period of 10 years, the number of floods between 2014 and 2023 had increased to 1,500, which means there were 6 times as many floods. The data indicate that the frequency and intensity of extreme precipitation events are increasing, which is one of the leading causes of flooding.

Total number of large-scale floods globally

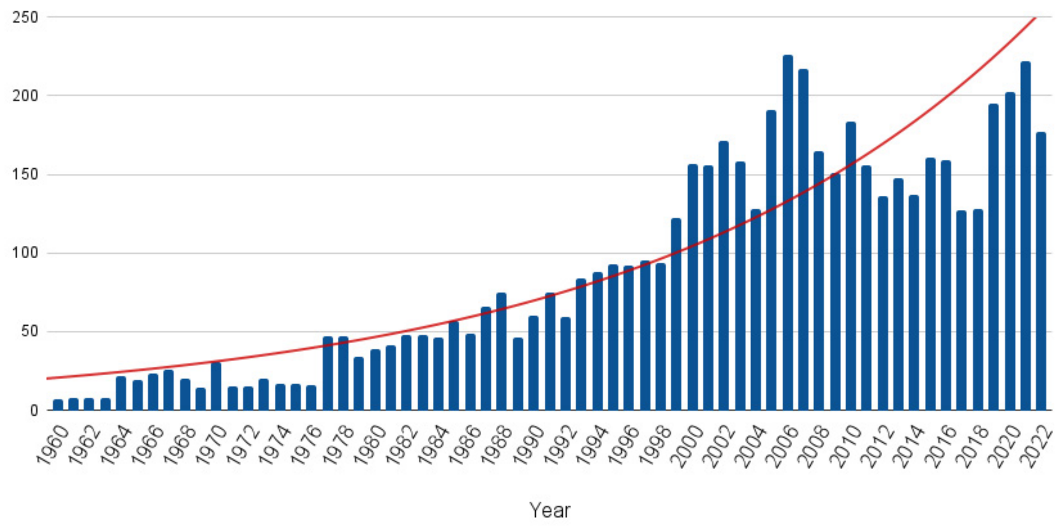


Figure 25

Number of large-scale floods globally from 1960 to 2022. Data source: The International Disaster Database (EM-DAT)

Moreover, the number of territories suffering from floods has increased significantly (Figure 26). While approximately 20 countries were annually affected by floods in the 1970s, the situation has drastically changed since the 2000s, with over 80 countries facing the impacts of floods each year – a fourfold increase.

Total number of countries affected by floods

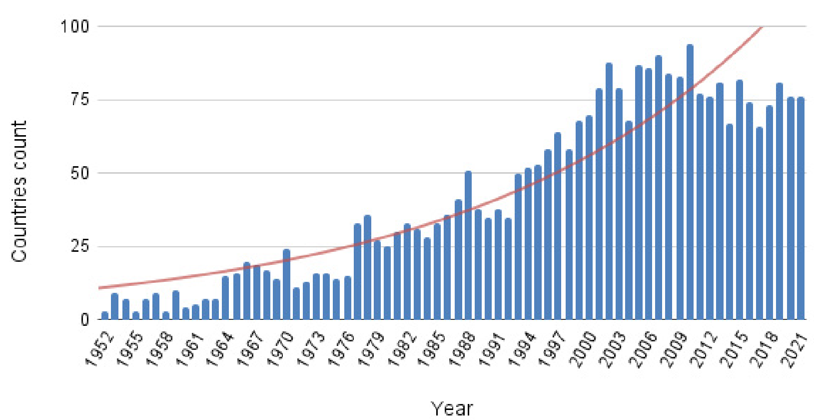


Figure 26

Number of countries affected by floods since 1960. Data source: The International Disaster Database (EM-DAT)

The frequency of abnormal precipitation events and record-breaking downpours is also increasing worldwide. According to the European Severe Weather Database (ESWD), there were 661 cases of abnormal precipitation in Europe between 2000 and 2004, but 29,031 between 2019 and 2023 (Figure 27). This means that anomalous precipitation has become 44 times more common. Abnormal precipitation is an event that exceeds the norm in intensity, duration, or frequency.

Abnormal precipitation events in Europe

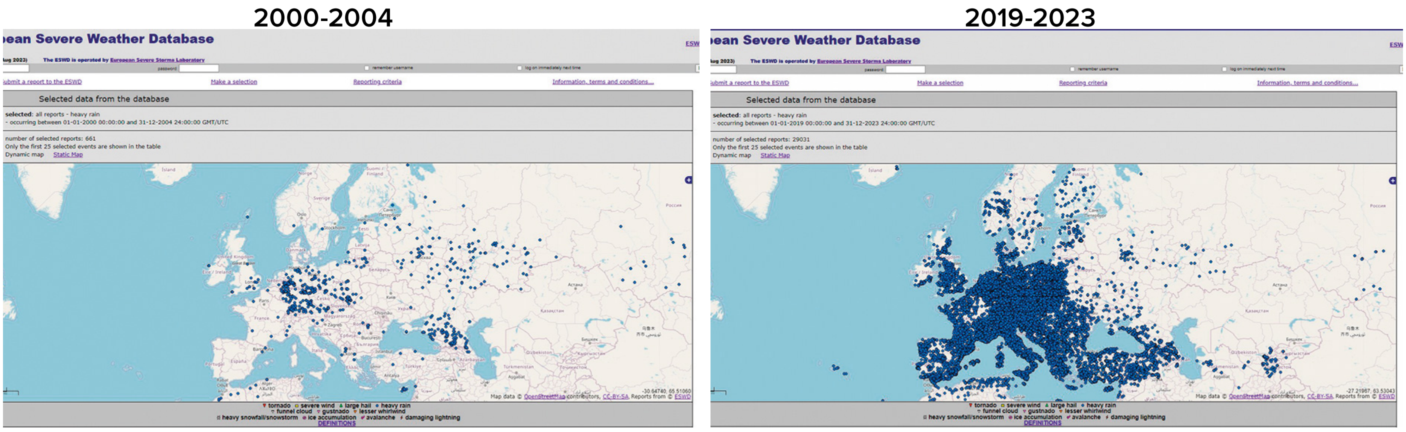


Figure 27

Abnormal precipitation events in Europe: a) 2000-2004, b) 2019-2023.
Data source: European Severe Weather Database (ESWD)
The map shows the distribution of abnormal precipitation in Europe over two five-year periods: 2000-2004 and 2019-2023. On the map of Europe, blue dots mark the locations where these events occurred. The more dots in a region, the more abnormal precipitation events have occurred there.

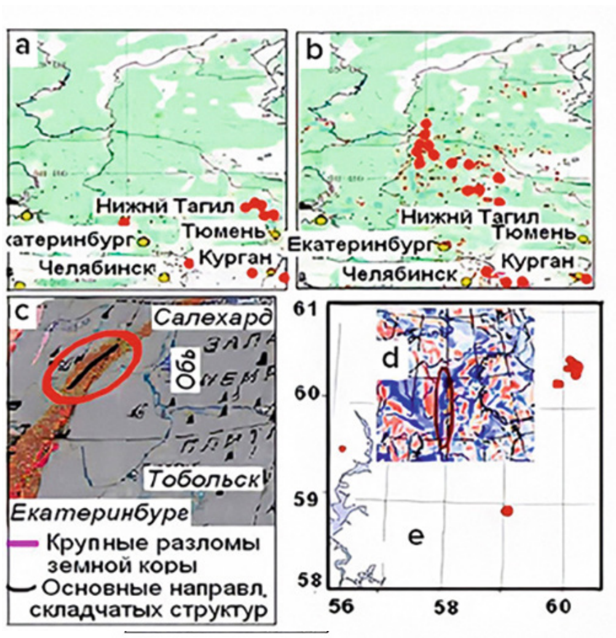
The number of droughts is also growing at record levels. According to the UN[7], the number of droughts globally has increased by 29% over the past 20 years. The UN report says that in 2022 and 2023, 1.84 billion people worldwide, or nearly a quarter of the world's population, were living under drought conditions. A record-high 258 million people are already facing 'severe hunger' due to the drought, and some are on the brink of starvation.

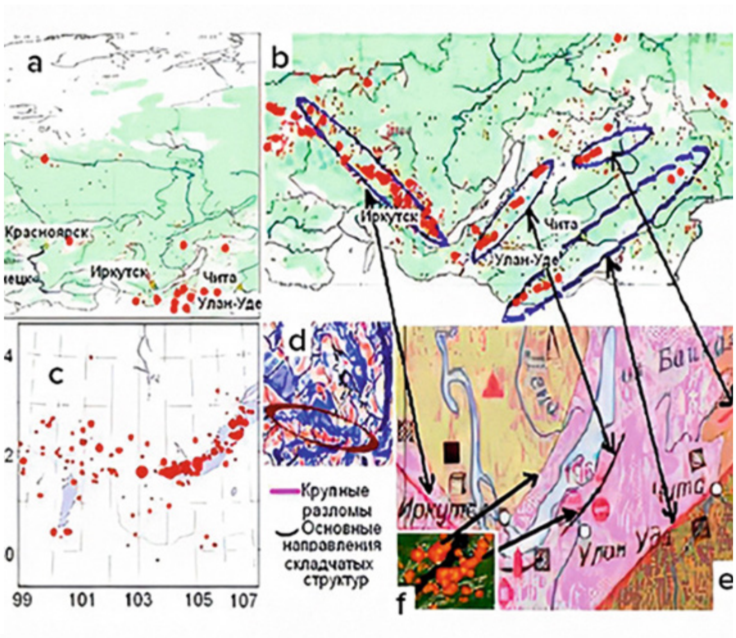
In 2023, many countries experienced catastrophic droughts that caused enormous economic losses.

[7] UN data https://www.un.org/en/observances/desertification-day

Increase in the Number of Wildfires

Lately, extinguishing natural wildfires has become increasingly challenging, even with modern firefighting equipment. According to the scientist Petr Vladimirovich Lyushvin[8], these fires occur in the fault zones of the Earth's crust where hydrogen, methane, and other flammable gasses escape from the depths (see Figures 28-29). As a result, these fires are extremely difficult to extinguish. Settlements and entire cities are engulfed in flames. Fires break out even in the northern region that are covered with snow.





Major faults in the Earth's crust
Main directions of fold structures

Figure 28

Coincidence of the locations of wildfires, earthquakes, crustal faults, and magnetic anomalies in the Ural region.
(a) - Wildfires in the summer of 2009;
(b) - Wildfires in the summer of 2010;
(c) - Major faults in the Earth's crust and the main directions of fold structures;
(d) - Earthquake epicenters from 1995 to 2013;
(e) - Magnetic field anomalies (blue shades indicate positive, red shades indicate negative deviations).
Source: https://regnum.ru/article/2395754

Figure 29

Coincidence of the locations of wildfires, earthquakes, crustal faults, and magnetic anomalies in Southern Siberia.
(a) - Wildfires in the summer of 2009;
(b) - Wildfires in the summer of 2010;
(c) - Earthquake epicenters from 1991 to 2017;
(d) - Magnetic field anomalies (blue shades indicate positive, red shades indicate negative deviations);
(e) - Major faults and the main directions of fold structures;
(f) - Wildfires in the Baikal region, arrows indicating the localization of fires near faults in the Earth's crust.
Source: https://regnum.ru/article/2395754

---

[8] Reference:
Lushvin, P. (2018). Natural Plain Fires and How to Minimize Them. Presentation at the 26th meeting of the All-Russian Interdisciplinary Seminar-Conference of the Geological and Geographical Faculties of Moscow State University "Planet Earth System," January 30 — February 2, 2018.
Lushvin, P., Buyanova, M. (2021). Development of Ice Cover in Water Areas during Methane. International Journal of Geosciences, 12(9), 927-940. https://doi.org/10.4236/ijg.2021.129047
Lushvin, P., Buyanova, M. (2021). History of Observations of Seismogenic Phenomena in the Atmosphere and Formalization of Their Decryption. International Journal of Atmospheric and Oceanic Sciences, 5(1), 13-19. https://doi.org/10.11648/j.ijaos.20210501.13

The area affected by extreme wildfires has sharply increased in various countries. Over the past 3 years, there has been unprecedented growth in the wildfire-affected areas in Canada, Australia, Spain, the United States, and Europe (see Figures 30-34).

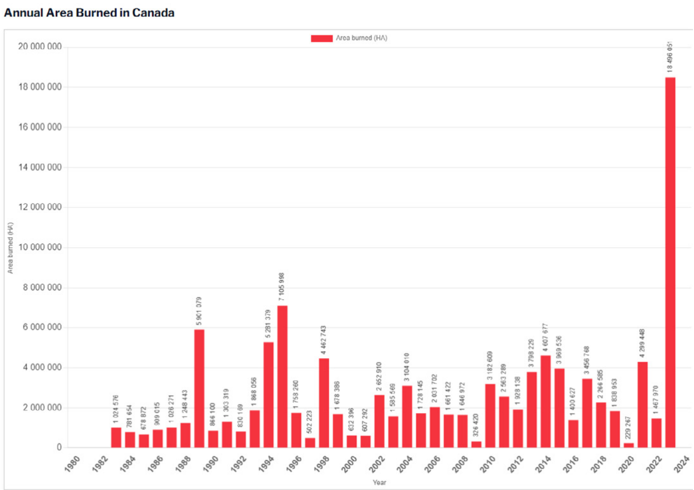


Figure 30

Annual Area Burned in Canada.
Source: Canadian Interagency Forest Fire Centre (CIFFC)

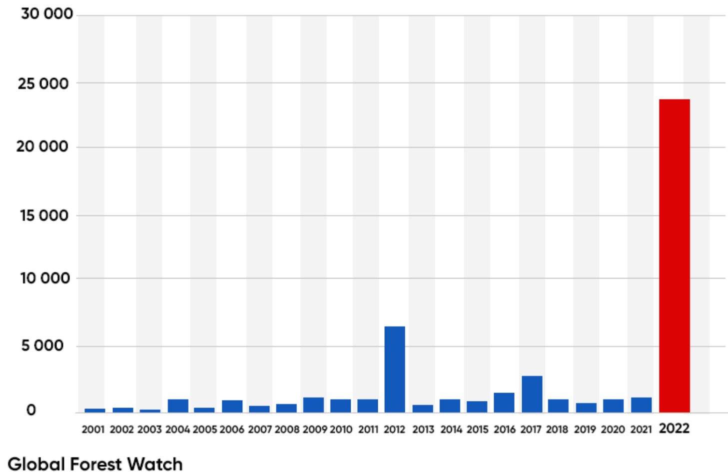


Figure 31

Loss of tree cover due to wildfires in Spain from 2001 to 2022.
Source: Global Forest Watch

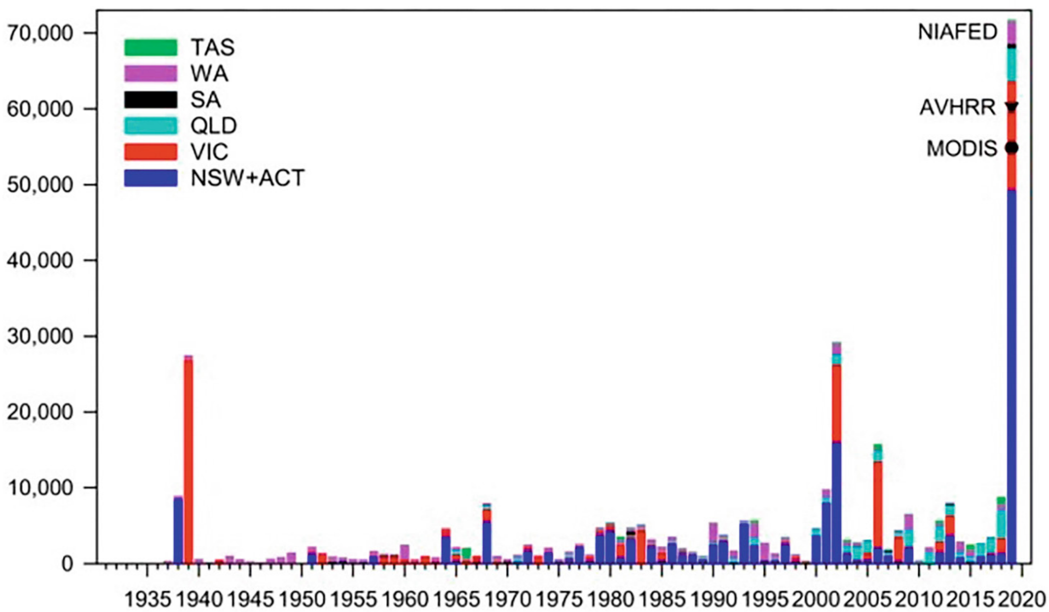


Figure 32

Area of burned forest ecosystems due to wildfires in New South Wales and the Australian Capital Territory (dark blue), Victoria (red), Queensland (light blue), South Australia (black), Western Australia (purple), and Tasmania (green) for fire-prone years from 1930 to 2019.
Source: Canadell, J., Meyer, C., Cook, G., Dowdy, A., Briggs, P., Knauer, J., Pepler, A. & Haverd, V. (2021). Multi-decadal increase of forest burned area in Australia is linked to climate change. Nature Communications, 12, 6921 (2021). DOI: 10.1038/s41467-021-27225-4.

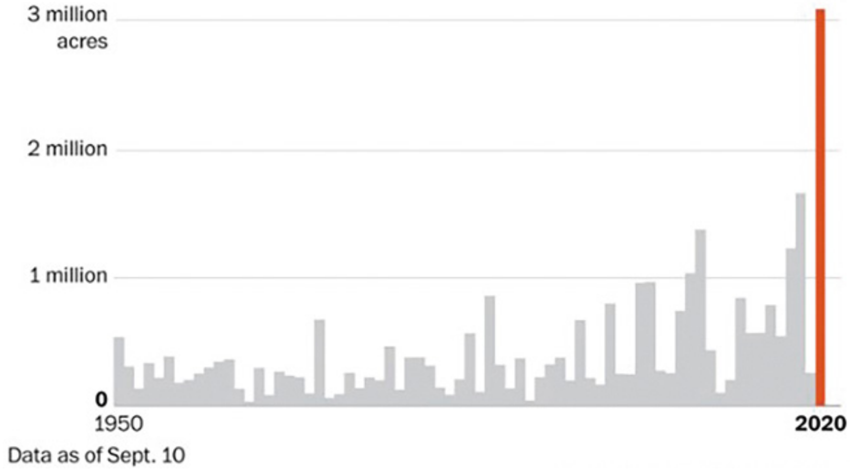


Figure 33

Total acres burned by fires in California. In 2020, the state set a record with over 3.1 million acres burned.
Source: California Department of Forestry and Fire Protection (CAL FIRE)

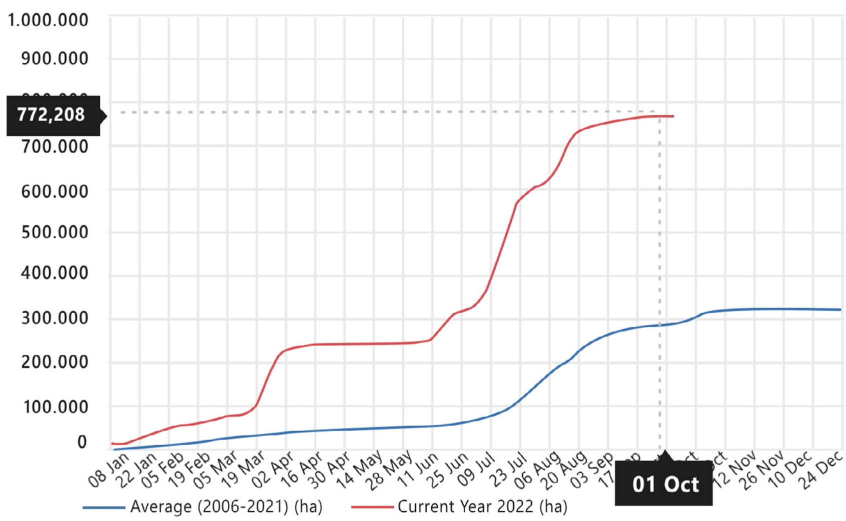


Figure 34

Cumulative area burnt in Europe by wildfires in 2022 (red) and annual average burnt between 2006-2021 (blue).
Source: European Forest Fire Information System

Another important factor contributing to the spread of fires is droughts caused by the escape of water along cracks and faults, which take place everywhere due to the deformation of the Earth's crust caused by the increased seismic activity as well the change in the equatorial and poleward diameters of the planet. According to satellite observations and climatic and hydrological models, over the past three decades, the volume of water has decreased in more than 50% of large natural lakes and reservoirs[9]. This phenomenon is particularly paradoxical given the disastrous increase in the number of severe flooding, unless the hydrodynamic changes in the upper parts of the Earth's crust caused by tectonic activities are taken into account.

[9] Yao, F., Livneh, B., Rajagopalan, B., Wang, J., Jean-François Crétaux, Wada, Y., & Berge-Nguyen, M. (2023). Satellites reveal widespread decline in global lake water storage. Science, 380(6646), 743–749. https://doi.org/10.1126/science.abo2812

World Ocean Heating

Ocean heating leads to an increase in the frequency and scale of extreme hydrometeorological events, including record floods, typhoons, and abnormal precipitation.

As of 2020, ocean warming has increased by 450% over the past 30 years (see Figure 35). Research shows that while oceans were steadily warming from 1955 to 1986, in the recent decades, the warming has rapidly accelerated.

According to scientists' estimates, to achieve the current rate of ocean warming would require as much energy as it would be released if 7 atomic bombs, like those dropped on Hiroshima, were released every second for a year. This fact raises the following rational question: "What is the source of such a significant amount of energy?"

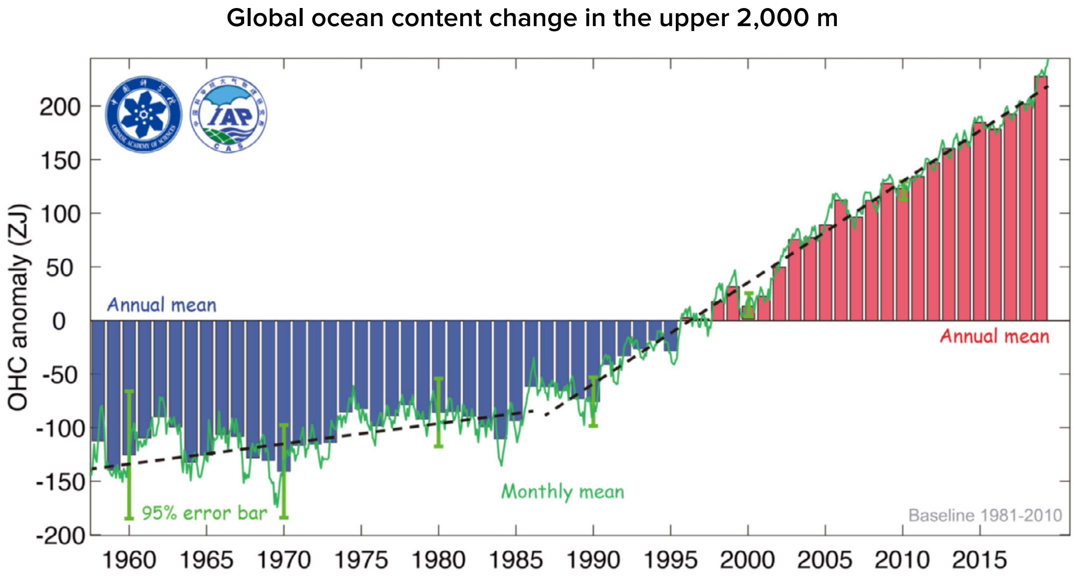


Figure 35

Changes in heat content in the upper 2000 meters of the World Ocean.
Source: Cheng, L., Abraham, J., Zhu, J., Trenberth, K. E., Fasullo, J., Boyer, T., Locarnini, R., Zhang, B., Yu, F., Wan, L., Chen, X., Song, X., Liu, Y., & Mann, M. E. (2020). Record-Setting Ocean Warmth Continued in 2019. Advances in Atmospheric Sciences, 37(2), 137–142. https://doi.org/10.1007/s00376-020-9283-7

The anomalous ocean heating is caused both by the anthropogenic factor and by the impact of magma, the ascent of which has been intensified since 1995. The oceanic crust, which is thinner than the continental crust, allows magma to heat the ocean floor more effectively, consequently warming the ocean itself.

There are several indications that the ocean is warming at depth. A group of researchers from the United States found that over the last 60 years, the average ocean depths have warmed 15 times faster than in the previous 10,000 years[10]. And this progression is accelerating each year. A vast amount of energy is required to raise temperatures at such depths where sunlight does not penetrate.

[10] Rosenthal, Y., Linsley, B. K., & Oppo, D. W. (2013). Pacific Ocean Heat Content During the Past 10,000 Years. Science, 342(6158), 617–621. https://doi.org/10.1126/science.1240837
Oppo, D. (2013, October 31). Is Global Heating Hiding Out in the Oceans? https://www.earth.columbia.edu/articles/view/3130

One of the factors contributing to the heating of ocean waters is the release of methane. Huge methane reserves in the form of gas hydrates (clathrates) are found on the seabed of the seas of the Arctic Ocean. Under the influence of geothermal heating, these accumulations are melting, releasing methane in gaseous form. Such methane releases occur in bursts and are called methane plumes or mega-bursts. An anomalous methane burst in the Arctic region was detected in the atmosphere by NOAA satellites in April 2014[11]. According to the geological structure of the seabed, areas with elevated methane concentrations match the fault lines of the Arctic mid-ocean ridges. Earthquakes indicate the activity of faults, shifts in magma chambers, and the release of heat fluxes.

The data showing increase in temperature at the ocean's deep layers indicate that the ocean is heating both from the top and from below. Significant warming trends are observed in two deep areas of the Argentine Basin[12] at depths greater than 4,500 meters: 0.02°C ± 0.01°C per decade between 2009 and 2019.

A temperature increase of 0.02°C ± 0.01°C represents a colossal amount of energy required to heat such a volume of cold water at the ocean floor.

An all-time historical record for ocean surface temperatures was broken in 2023 (Figure 36). The year 2024 has already surpassed all the records set in 2023, and it appears that the trend of subsequent changes may exceed the ranges presented on the graph.

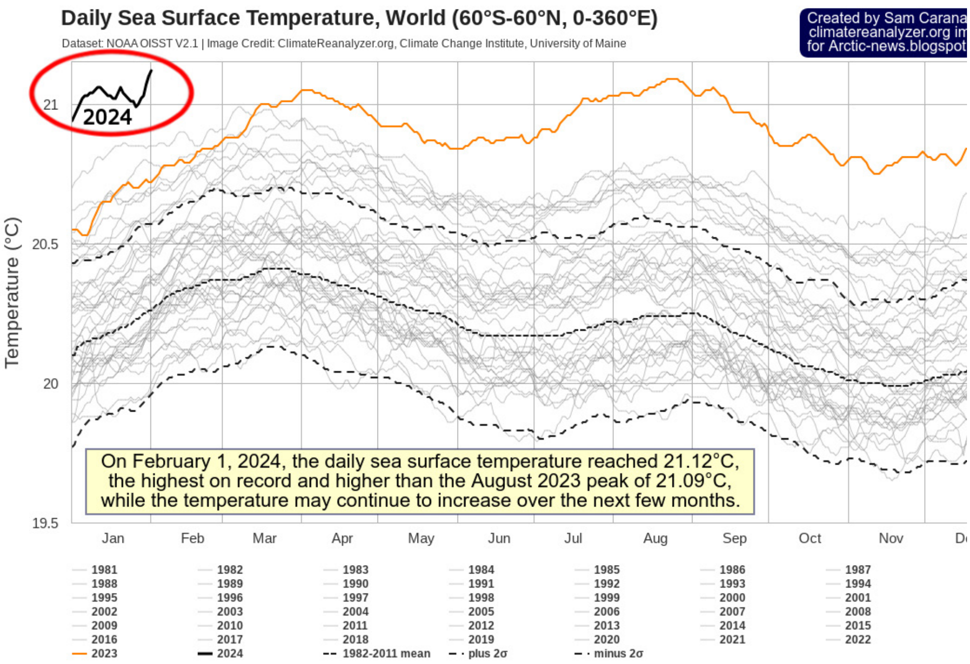


Figure 36

Highest Ocean Temperatures on Record, Daily Average Sea Surface Temperature, 1981-2024.
Data source: Dataset NOAA OISST V2.1 | Image Credit: ClimateReanalyzer.org, Climate Change Institute, University of Maine, Dataset. NOAA OISS

[11] Yurganov, L. N., Leifer, I., & Sunil Vadakkepuliyambatta. (2017). Evidences of accelerating the increase in the concentration of methane in the atmosphere after 2014: satellite data for the Arctic. Sovremennye problemy distancionnogo zondirovaniâ Zemli iz kosmosa [Current problems in remote sensing of the Earth from Space] 14(5), 248–258. https://www.researchgate.net/publication/317587506_Evidences_of_accelerating_the_increase_in_the_concentration_of_methane_in_the_atmosphere_after_2014_satellite_data_for_the_Arctic

[12] Meinen, C. S., Perez, R. C., Dong, S., Piola, A. R., & Campos, E. (2020). Observed Ocean Bottom Temperature Variability at Four Sites in the Northwestern Argentine Basin: Evidence of Decadal Deep/Abyssal Warming Amidst Hourly to Interannual Variability During 2009–2019. Geophysical Research Letters, 47(18). https://doi.org/10.1029/2020gl089093

Another evidence for the heating of the world's ocean waters is the occurrence of ocean heatwaves, which are localized, long-lasting areas of heated ocean water. A particular example of these are blobs, which cover huge areas of surface water and have unusually high temperatures. Since 1995, the number of blobs has increased significantly[13], and they have become more common in different parts of the world's ocean, including those off the coasts of New Zealand, South West Africa, and the southern Indian Ocean.

One of the most well-known and largest blobs was formed in the Gulf of Alaska in 2013 and spread rapidly across the Pacific. It covered an area of more than 4,000,000 square kilometers (larger than the size of India) and the water temperatures were 5-6 degrees Celsius above average in some places (Figure 37). The blob traveled across the ocean from Alaska to Mexico for three years until 2016 (Figure 38). This phenomenon negatively affected the marine ecosystem and climate in the region.

One of the theories behind the origin of this blob is most likely the active volcanism off the coast of Alaska and the Cobb[14] magma plume, which heated the water at the bottom of the ocean and forced this huge volume of heated water to rise to the surface.

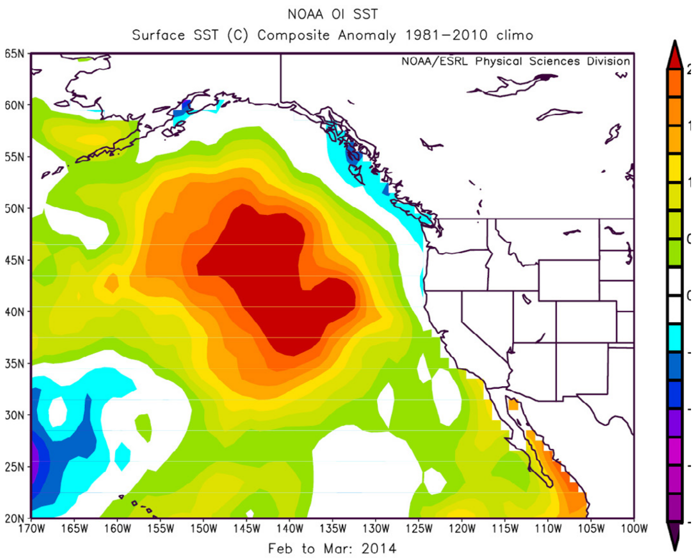


Figure 37

Map shows position of sea surface temperature (SST) anomaly, aka The Blob, in the northeast Pacific Ocean in March 2014. (Image provided by the NOAA/ESRL Physical Sciences Division at Boulder, Colorado)

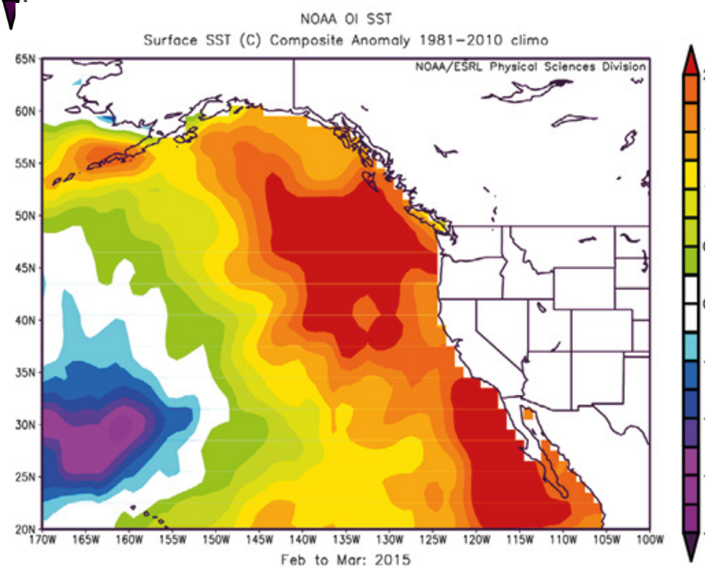


Figure 38

Map shows how the sea surface temperature (SST) anomaly had moved and spread along the West Coast by March 2015. (Image provided by the NOAA/ESRL Physical Sciences Division at Boulder, Colorado)

[13] Laufkötter, C., Zscheischler, J., & Frölicher, T. L. (2020). Science, 369(6511), 1621–1625. https://doi.org/10.1126/science.aba0690

[14] Chadwick, J., Keller, R., Kamenov, G., Yogodzinski, G., & Lupton, J. (2014). The Cobb hot spot: HIMU-DMM mixing and melting controlled by a progressively thinning lithospheric lid. Geochemistry, Geophysics, Geosystems, 15(8), 3107–3122. https://doi.org/10.1002/2014gc005334

In December 2019, a blob appeared east of New Zealand in the South Pacific, with temperatures 6°C above average on certain days. The blob covered an area of more than one million square kilometers, which is nearly 1.5 times the size of Texas, or four times larger than New Zealand (Figure 39). It was reported to be the largest blob in the world ocean at the time. It was also the second largest event ever recorded in the region. James Renwick, the head of the School of Geography, Environment and Earth Sciences at Victoria University in Wellington, said: “It’s the biggest patch of above average warming on the planet right now. Normally the temperatures there are about 15 °C, but at the moment, they are about 20 °C”[15].

The cause of this blob formation was likely the activity of an ancient volcanic plateau off the coast of New Zealand[16].

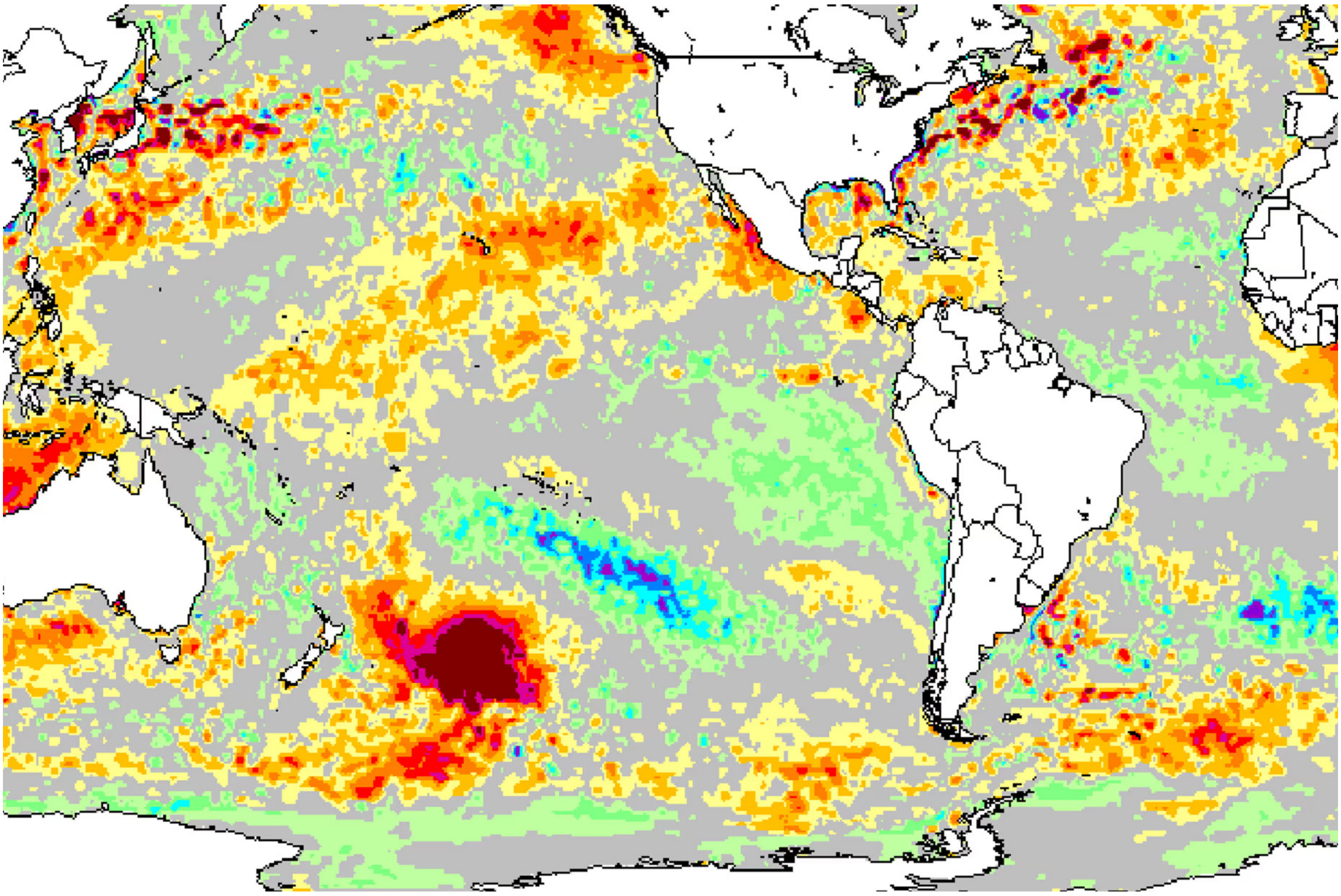


Figure 39

Sea surface temperature anomaly in the South Pacific on December 25, 2019.
Source: Morton, A. (2019, December 27). Hot blob: vast patch of warm water off New Zealand coast puzzles scientists. The Guardian. https://www.theguardian.com/world/2019/dec/27/hot-blob-vast-and-unusual-patch-of-warm-water-off-new-zealand-coast-puzzles-scientists

[15] Morton, A. (2019, December 27). Hot blob: vast patch of warm water off New Zealand coast puzzles scientists. The Guardian. https://www.theguardian.com/world/2019/dec/27/hot-blob-vast-and-unusual-patch-of-warm-water-off-new-zealand-coast-puzzles-scientists

[16] Gase, A., Bangs, N. L., Saffer, D. M., Han, S., Miller, P., Bell, R., Arai, R., Henrys, S. A., Shiraishi, K., Davy, R., Frahm, L., & Barker, D. (2023). Subducting volcaniclastic-rich upper crust supplies fluids for shallow megathrust and slow slip. Science Advances, 9(33). https://doi.org/10.1126/sciadv.adh0150

The theory that the emergence of marine heatwaves and oceanic blobs is caused by the heating of deep waters at the ocean floor is aligned with new research conducted by scientists from the Ocean University of China[17]. They have shown that a third of marine heatwaves do not manifest themselves in any way at the ocean surface, and about half do not manifest themselves at all stages of their life cycle. The annual number of these subsurface marine heatwaves has significantly increased due to ocean warming over the past three decades. The fact that a significant fraction of marine heatwaves is not even observed at the ocean surface probably indicates that they cannot be caused by warmth from the atmosphere.

Therefore, in addition to the anthropogenic factor, the cause of the formation of marine heatwaves, including blobs, is the underwater volcanic activity and magma rising from the Earth's interior to the oceanic crust, which began in 1995. This leads to the heating of deep water layers that rise vertically from the ocean floor to the surface, forming anomalously heated areas of the ocean. Blobs in the ocean lead to changes in atmospheric pressure, anomalies in winds and currents, general heating of the ocean and destruction of ecosystems. As magmatic activity increases, the number and size of such ocean heatwaves will increase.

One of the significant effects from marine heatwaves is changes in the parameters of ocean currents, for example, slowing down of the Gulf Stream from May to August 2010. According to geologist James Kamis, the rise of magma, which caused the volcanic eruption, likely heated the water on the ocean floor.[18] As a result, according to observations, in May 2010, a massive volume of hot water surfaced above the tectonic zone beneath Greenland, which is believed to have blocked the path of the Gulf Stream for some time (Figure 40). This led to a temporary change in weather patterns in Europe and North America. A more considerable weakening or stopping of the Gulf Stream could lead to major changes in the climate, ecosystems, and economies of Europe and North America.

At present, due to the anthropogenic factor and increased magmatic activity that contributes to the heating of the deep ocean layers, the Gulf Stream is in danger of weakening, halting or disappearing completely.

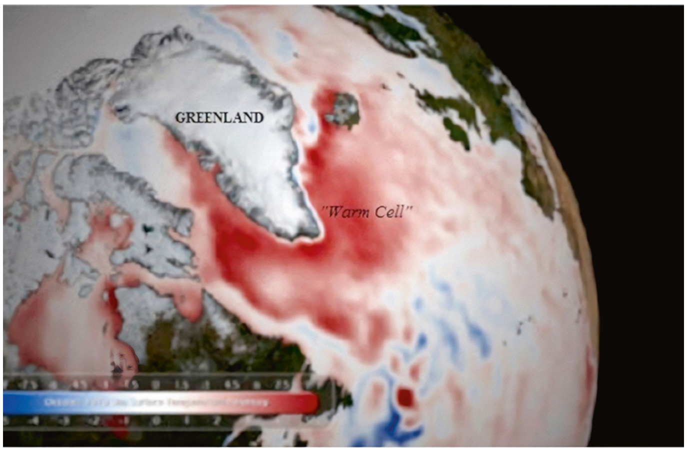


Figure 40

The map of ocean surface temperatures for May 2010, illustrating the 2009-2010 marine heatwave in the North Atlantic Ocean (shown in red).
Source: Kamis, J. E. (n.d.). Geologically Induced Northern Atlantic Ocean "Warm Blob" Melting Southern Greenland Ice Sheet. Plate Climatology. https://www.plateclimatology.com/geologically-induced-northern-atlantic-ocean-warm-blob-melting-southern-greenland-ice-sheet?rq=Alaska

[17] Sun, D., Li, F., Jing, Z., Hu, S., & Zhang, B. (2023). Frequent marine heatwaves hidden below the surface of the global ocean. Nature Geoscience, 16(12), 1099–1104. https://doi.org/10.1038/s41561-023-01325-w

[18] Kamis, J. E. (n.d.). Geologically Induced Northern Atlantic Ocean "Warm Blob" Melting Southern Greenland Ice Sheet. Plate Climatology. https://www.plateclimatology.com/geologically-induced-northern-atlantic-ocean-warm-blob-melting-southern-greenland-ice-sheet?rq=Alaska

Anomalous Glacial Melting in Antarctica and Greenland

Over the past 29 years, the loss of ice on major ice sheets has accelerated. The rate of ice loss in Greenland is now 400% higher, while in Antarctica it is 25% higher than in the early 1990s[19].

Let's consider the example of Antarctica. Studies show that since 1992, Antarctica has lost nearly three trillion tons of ice[20], which is equivalent to 1.2 billion Olympic-size swimming pools. The Pine Island Glacier, which is considered Antarctica's most vulnerable point, loses about 45 billion tons of ice each year[21]. Antarctica's second most prominent glacier is the Thwaites Glacier giant ice shelf.

86% of all ice losses in Antarctica occur in West Antarctica, where there is rapid retreat and thinning of the Pine Island and Thwaites glaciers (Rignot et al. 2014; Shepherd et al. 2002) (Figures 41-43).

The surprising fact is that glaciers are melting predominantly in the western part of the continent only.

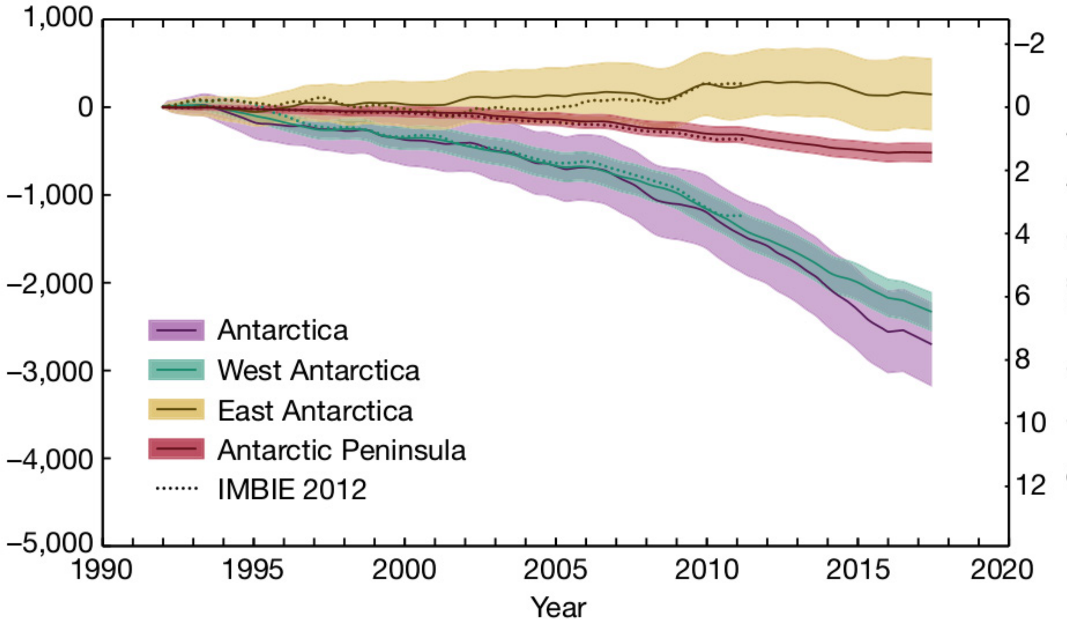


Figure 41

Ice mass and sea level changes in Antarctica during 1992-2017. Purple curve is the average rate of ice loss in Antarctica. Green curve is the rate of ice loss in West Antarctica. Yellow curve is the positive trend, that is, ice gain in East Antarctica.
Source: The IMBIE Team. (2018). Mass balance of the Antarctic Ice Sheet from 1992 to 2017. Nature, 558, 219–222. https://doi.org/10.1038/s41586-018-0179-y

[19] Otosaka, I. N., Horwath, M., Mottram, R. & Nowicki, S. (2023). Mass Balances of the Antarctic and Greenland Ice Sheets Monitored from Space. Surveys in Geophysics, 44:1615–1652. DOI: 10.1007/s10712-023-09795-8

[20] The IMBIE Team. (2018). Mass balance of the Antarctic Ice Sheet from 1992 to 2017. Nature, 558, 219–222. https://doi.org/10.1038/s41586-018-0179-y

[21] Seroussi, H., Morlighem, M., Rignot, E., Mouginot, J., Larour, E., Schodlok, M., & Khazendar, A. (2014). Sensitivity of the Dynamics of Pine Island Glacier, West Antarctica, to climate forcing for the next 50 years. The Cryosphere, 8(5), 1699–1710. https://doi.org/10.5194/tc-8-1699-2014

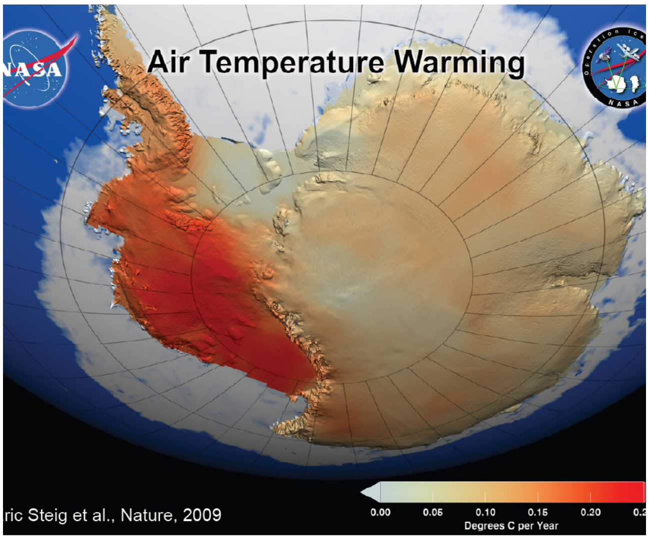


Figure 42

The NASA map illustrates significant surface warming of the West Antarctic Ice Sheet and the Antarctic Peninsula. The warming is considerably more intense than previously reported, exceeding 0.1 degrees Celsius in a decade, with the most significant impact observed during winter and spring. The image incorporates temperature data collected over a 50-year period from 1957 to 2006 (NASA/GSFC Scientific Visualization Studio 2008)
https://earthobservatory.nasa.gov/images/36736/antarctic-warming-trends

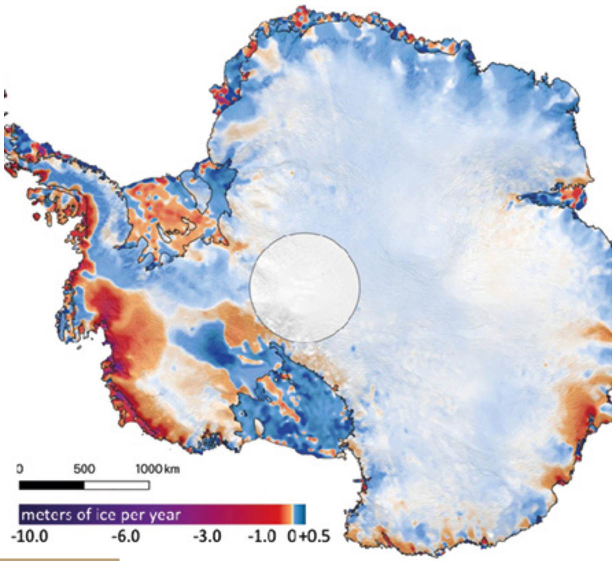


Figure 43

The map depicts the amount of ice accumulated or lost by Antarctica from 2003 to 2019. Purple and dark red colors indicate high and moderate rates of ice loss along the Antarctic coast, respectively, while blue colors indicate rates of ice growth inland.
Source: Smith, B., Fricker, H. A., Gardner, A. S., Medley, B., Nilsson, J., Paolo, F. S., Holschuh, N., Adusumilli, S., Brunt, K., Csatho, B., Harbeck, K., Markus, T., Neumann, T., Siegfried, M. R., & Zwally, H. J. (2020). Pervasive ice sheet mass loss reflects competing ocean and atmosphere processes. Science, 368(6496), 1239–1242. https://doi.org/10.1126/science.aaz5845

It is interesting to note that West Antarctica is one of the largest volcanic regions on Earth, where more than 140 volcanoes have been found under ice (Figure 44).

Based on the aeromagnetic observations, scientists from Germany and the British Antarctic Survey have created a map of the geothermal heat flow in West Antarctica and discovered a zone of inflow of large amounts of geothermal heat from the Earth's interior under the Thwaites Glacier [22,23]. The geothermal flow under West Antarctica corresponds to zones of increased glacial melting.

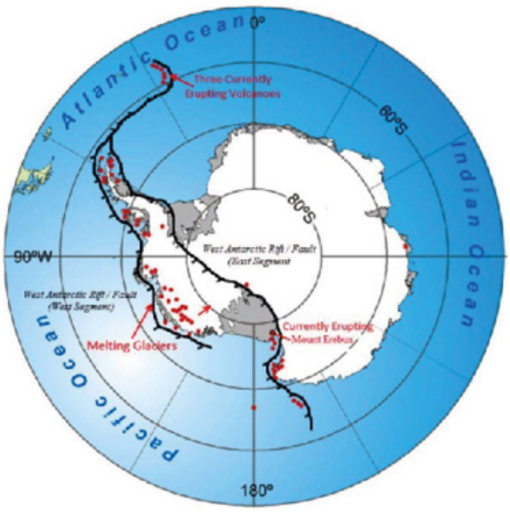


Figure 44

Map of "active" (currently erupting) or "dormant" (potentially active) volcanoes on the Antarctic continent located along the extensive West Antarctic Rift System. This active fault zone breaks up the continent and allows suboceanic hot magma to flow up the faults, thus feeding the volcanoes.
https://www.plateclimatology.com/west-antarctic-glacial-melting-from-deep-earth-geological-heat-flow-not-global-warming

[22] Damiani, T. M., Jordan, T. A., Ferraccioli, F., Young, D. A., & Blankenship, D. D. (2014). Variable crustal thickness beneath Thwaites Glacier revealed from airborne gravimetry, possible implications for geothermal heat flux in West Antarctica. Earth and Planetary Science Letters, 407, 109–122. https://doi.org/10.1016/j.epsl.2014.09.023
[23] Dziadek, R., Ferraccioli, F., & Gohl, K. (2021). High geothermal heat flow beneath Thwaites Glacier in West Antarctica inferred from aeromagnetic data. Communications Earth & Environment, 2(16). https://doi.org/10.1038/s43247-021-00242-3

A team of scientists from the University of Rhode Island and the University of East Anglia discovered a new factor in the rapid melting of the Pine Island Glacier in Antarctica: a previously unknown active volcano buried deep under the ice[24]. The scientists discovered volcanic activity beneath the ice sheet, showing 25 times more thermal energy than that of a dormant volcano.

NASA scientists have identified a massive magma plume called Marie Byrd[25] beneath West Antarctica, with an area of almost one million square kilometers (Figure 45). Marie Byrd Land Volcanic Province is a region in West Antarctica characterized by high volcanic activity. The volcanism in Marie Byrd is attributed to a hotspot where a mantle plume (a stream of hot magma rising from deep within the Earth's mantle) reaches the Earth's crust and causes volcanic activity. According to scientists' calculations, the heat from the mantle plume is heating the rock and ice layers above it with almost as much energy as the Yellowstone supervolcano, which is 150 mW per square meter and reaches 180 mW per square meter in the fault zones. That's about three times as much heat as in the neighboring rock layers.

The Marie Byrd magma plume in West Antarctica

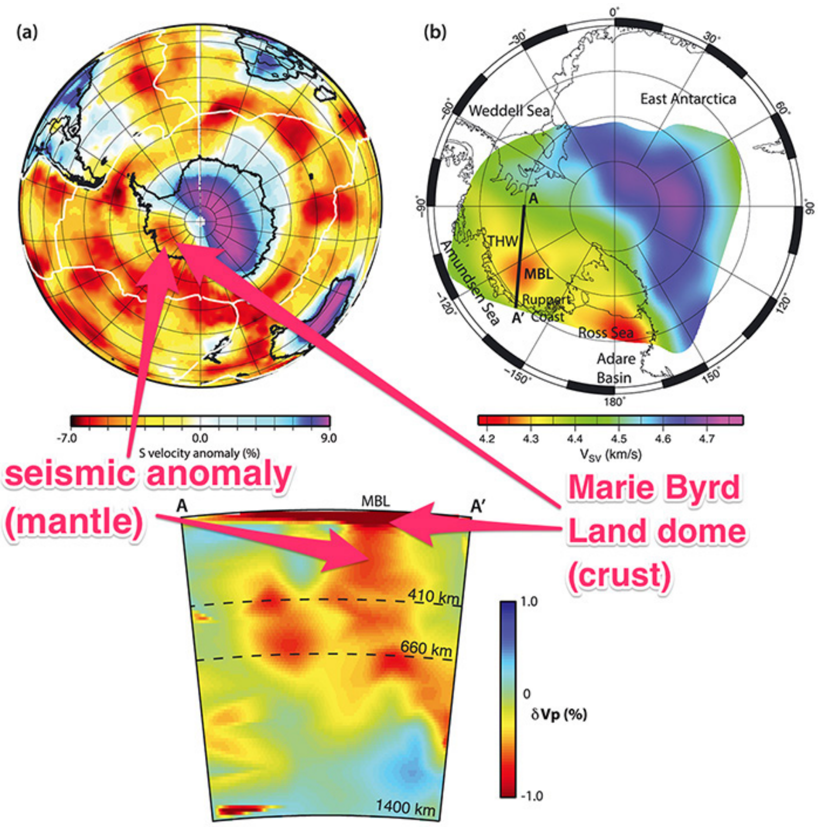


Figure 45

Presence of a hot mantle plume beneath the Marie Byrd region, West Antarctica, indicated by seismic tomography. (Helene Seroussi et al./JGR Solid Earth; Business Insider)
Source: Seroussi, H., Ivins, E. R., Wiens, D. A., & Bondzio, J. (2017). Influence of a West Antarctic mantle plume on ice sheet basal conditions. Journal of Geophysical Research: Solid Earth, 122(9), 7127–7155. https://doi.org/10.1002/2017jb014423

[24] Loose, B., Naveira Garabato, A. C., Schlosser, P., Jenkins, W. J., Vaughan, D., & Heywood, K. J. (2018). Evidence of an active volcanic heat source beneath the Pine Island Glacier. Nature Communications, 9(2431). https://doi.org/10.1038/s41467-018-04421-3

[25] Seroussi, H., Ivins, E. R., Wiens, D. A., & Bondzio, J. (2017). Influence of a West Antarctic mantle plume on ice sheet basal conditions. Journal of Geophysical Research: Solid Earth, 122(9), 7127–7155. https://doi.org/10.1002/2017jb014423

Scientists from the University of Bremen, the German Institute for Polar and Marine Research, and the British Antarctic Survey, have confirmed that the melting of major glaciers occurs in areas with elevated heat flow from the Earth's interior (Figure 46).

It is evident that compared to the previous studies in 2019 (left map), significant changes occurred in 2021 (right map), and the geothermal heat flow has increased. This indicates an increase in the heat flow coming from magma plumes in the Earth's interior.

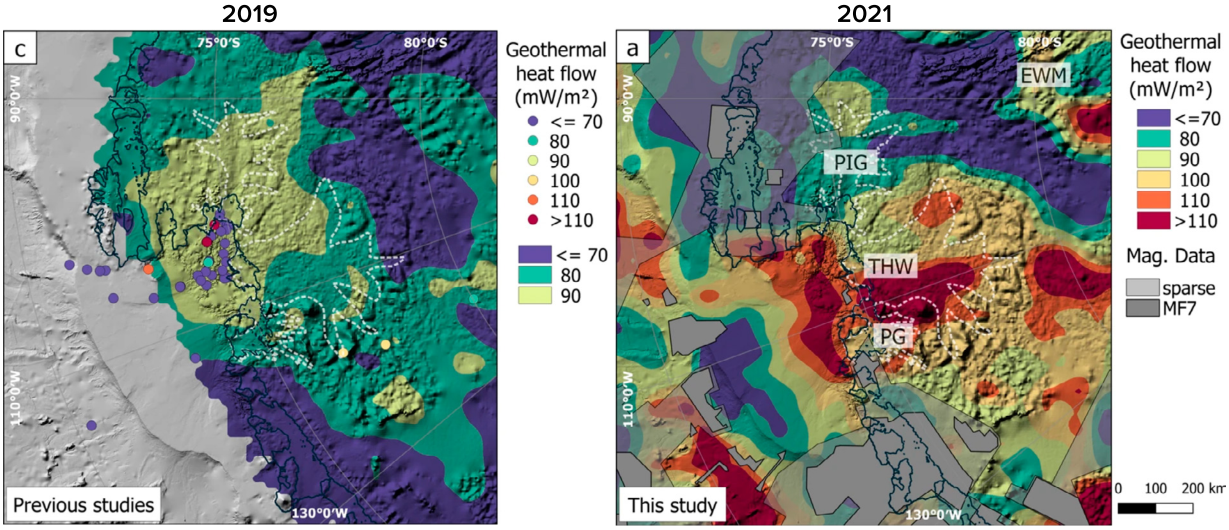


Figure 46

Distribution of geothermal heat flow in 2019 (left) and 2021 (right).
Source: Dziadek, R., Ferraccioli, F., & Gohl, K. (2021). High geothermal heat flow beneath Thwaites Glacier in West Antarctica inferred from aeromagnetic data. Communications Earth & Environment, 2(16). https://doi.org/10.1038/s43247-021-00242-3

A new international study has revealed that the Earth's crust is rising in some parts of West Antarctica at one of the fastest rates ever recorded. The uplift rate in the Amundsen Sea opposite the Pine Island Glacier is 41 millimeters per year, which is three times faster than in other areas[26]. Even in places like Iceland and Alaska, where rapid uplift is observed, the typical uplift is around 20-30 millimeters per year. Thus, scientists have concluded that the mantle beneath West Antarctica is hotter and more fluid than previously expected.

Therefore, the intense melting of the Antarctic ice sheet is attributed both to the water heating due to the anthropogenic factor as well as the geothermal heat from volcanic and magmatic activity, which has significantly increased since 1995 and continues to rise.

Directly off the coast of West Antarctica, there is anomalous heating of the deep waters of the Weddell Sea[27]. While the upper 700 meters of water show little warming, there is a consistent increase in temperature in deeper regions. On one side, the Weddell Sea borders the West Antarctic Rift, and on the other side, it is adjacent to an underwater volcanic ridge with the South Sandwich Islands. It is worth noting that the region of the South Sandwich Islands is one of the most seismically active areas on Earth. Here, seismic activity is rapidly increasing, indicating magma uplift.

[26] Barletta, V. R., Bevis, M., Smith, B. E., Wilson, T., Brown, A., Bordoni, A., Willis, M., Khan, S. A., Rovira-Navarro, M., Dalziel, I., Smalley, R., Kendrick, E., Konfal, S., Caccamise, D. J., Aster, R. C., Nyblade, A., & Wiens, D. A. (2018). Observed rapid bedrock uplift in Amundsen Sea Embayment promotes ice-sheet stability. Science, 360(6395), 1335–1339. https://doi.org/10.1126/science.aao1447
[27] Strass, V. H., Rohardt, G., Kanzow, T., Hoppema, M., & Boebel, O. (2020). Multidecadal warming and density loss in the Deep Weddell Sea, Antarctica. Journal of Climate, 33(22), 9863–9881. https://doi.org/10.1175/jcli-d-20-0271.1

Let us examine the melting of the Greenland ice sheet. Currently, the ice in Greenland is melting faster than at any time over the last 12,000 years[28]. Figure 47 shows a graph depicting an exponential increase in Greenland's ice loss from 1992 to 2018. Greenland's ice loss started in the 1990s, but the period from 2006 to 2012 accounted for nearly half of the total loss. Despite colder atmospheric conditions in the Greenland region, the rate of ice loss remained high after this period. In July 2019 alone, Greenland's ice sheet lost 197 billion metric tons of ice, roughly equivalent to about 80 million Olympic-size swimming pools.

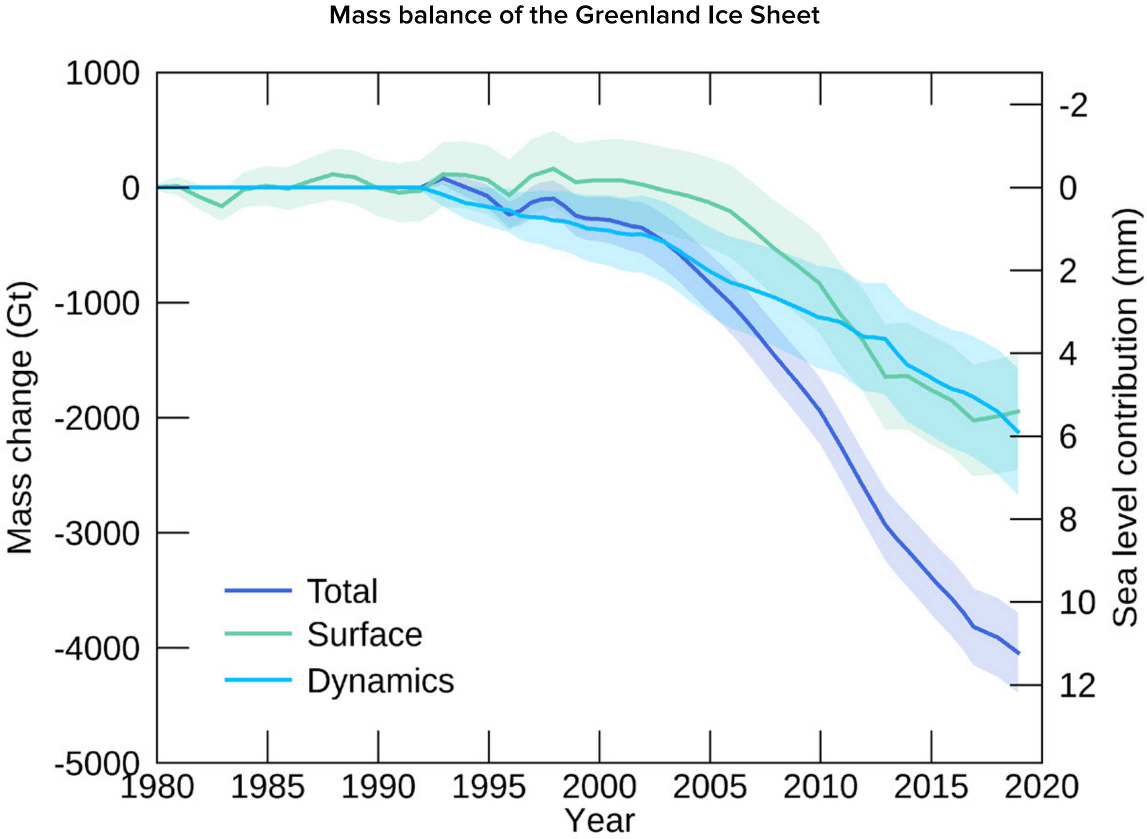


Figure 47

Total cumulative Greenland ice sheet mass change, partitioned into two components: surface and dynamic (the portion of the glacier mass loss caused by its movement and iceberg calving). Change relative to 1992.
Data source: IMBIE (Shepherd et al., 2020), Credit: IMBIE/ESA/NASA.

Rivers are flowing and lakes are appearing on the surface of the Greenland ice sheet, but surprisingly, rivers and lakes have also been discovered beneath the ice sheet, which is about 1.5 kilometers thick. Around 60 subglacial lakes have been discovered to date[29].

The commonly known reason for the formation of these lakes is geothermal heat and meltwater flowing through the cracks. These lakes form because the ice sheet is now melting from both the top and the bottom.

[28] Briner, J. P., Cuzzone, J. K., Badgeley, J. A., Young, N. E., Steig, E. J., Morlighem, M., Schlegel, N.-J., Hakim, G. J., Schaefer, J. M., Johnson, J. V., Lesnek, A. J., Thomas, E. K., Allan, E., Bennike, O., Cluett, A. A., Csatho, B., de Vernal, A., Downs, J., Larour, E., & Nowicki, S. (2020). Rate of mass loss from the Greenland Ice Sheet will exceed Holocene values this century. Nature, 586(7827), 70–74. https://doi.org/10.1038/s41586-020-2742-6

[29] Bowling, J. S., Livingstone, S. J., Sole, A. J., & Chu, W. (2019). Distribution and dynamics of Greenland subglacial lakes. Nature Communications, 10(2810). https://doi.org/10.1038/s41467-019-10821-w

A group of American scientists, led by Professor Ralph von Frese from Ohio State University, used gravitational research to estimate the thickness of the crust beneath Greenland. They discovered that the most significant glacier melting occurs in the northern part of the island, where the Earth's crust is thinnest. In this region, an elevated geothermal heat flow is observed due to the rising mantle plume[30].

Furthermore, a group of scientists led by researchers from the Schmidt Institute of Physics of the Earth, Irina Rogozhina and Alexey Petrunin[31], reached the same conclusion. Based on seismic tomography data, researchers discovered a mantle plume in Greenland's interior.

The magma flow rises from the core-mantle boundary, approaching the Earth's surface directly under the central part of the island. This phenomenon is likely to serve as an additional factor contributing to ice melt. It is in this area that the largest number of subglacial lakes are located (Figures 48-49).

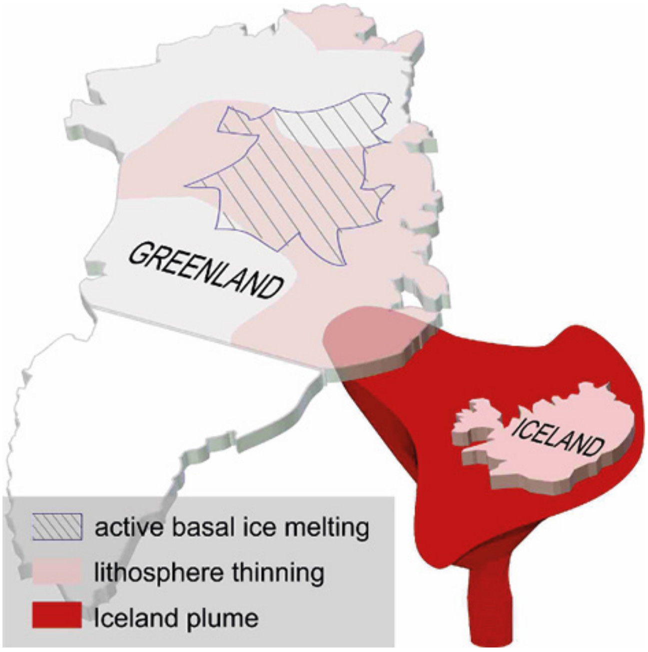


Figure 49

Illustration by Ivan Kulakov, Russian geophysicist, expert in geophysics and geodynamics, corresponding member of the Russian Academy of Sciences.
Source: https://www.vsegei.ru/ru/about/news/97448/?sphrase_id=1444325

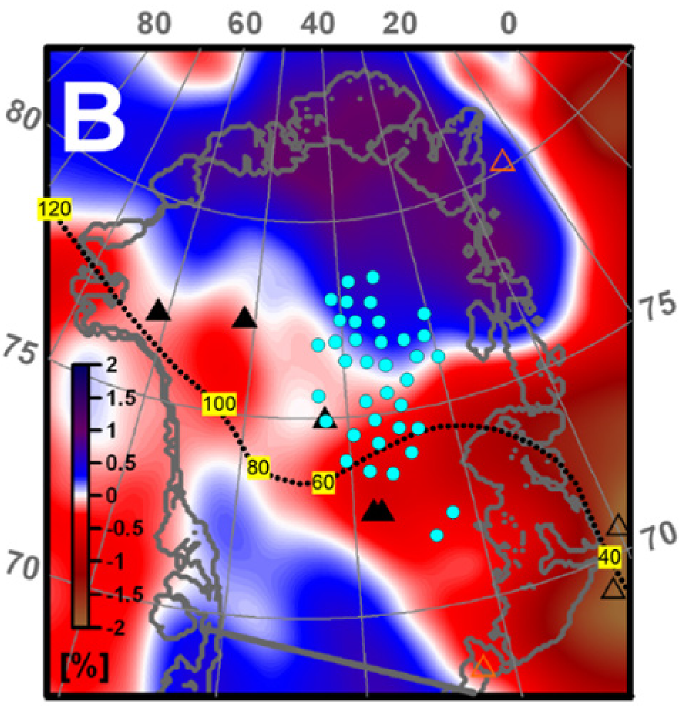


Figure 48

Seismic tomography of Greenland at 150 km depth. Low-velocity areas corresponding to regions of increased temperature are highlighted in red. The dotted line represents one of the potential plume 'track' reconstructions with age indicated in millions of years. Blue dots are areas where radar survey results showed that water is present under the glacier.
Source: Rogozhina, I., Petrunin, A. G., Vaughan, A. P. M., Steinberger, B., Johnson, J. V., Kaban, M. K., Calov, R., Rickers, F., Thomas, M., & Koulakov, I. (2016). Melting at the base of the Greenland ice sheet explained by Iceland hotspot history. Nature Geoscience, 9, 366–369. https://doi.org/10.1038/ngeo2689

[30] van der Veen, C. J., Leftwich, T., von Frese, R., Csatho, B. M., & Li, J. (2007). Subglacial topography and geothermal heat flux: Potential interactions with drainage of the Greenland ice sheet. Geophysical Research Letters, 34(12). https://doi.org/10.1029/2007gl030046

[31] Rogozhina, I., Petrunin, A. G., Vaughan, A. P. M., Steinberger, B., Johnson, J. V., Kaban, M. K., Calov, R., Rickers, F., Thomas, M., & Koulakov, I. (2016). Melting at the base of the Greenland ice sheet explained by Iceland hotspot history. Nature Geoscience, 9, 366–369. https://doi.org/10.1038/ngeo2689

The scientists have calculated the theoretical heat flow from this magma plume and found that this heat is enough to warm the base of the glacier to the point of melting the ice. Many researchers, including those utilizing machine learning techniques[32,33], obtained similar results later. Studies by scientists from Tohoku University in Japan provided further insight into the structure of the magma plume beneath Greenland[34] (Figures 50-51).

Magmatic plume beneath Greenland, model

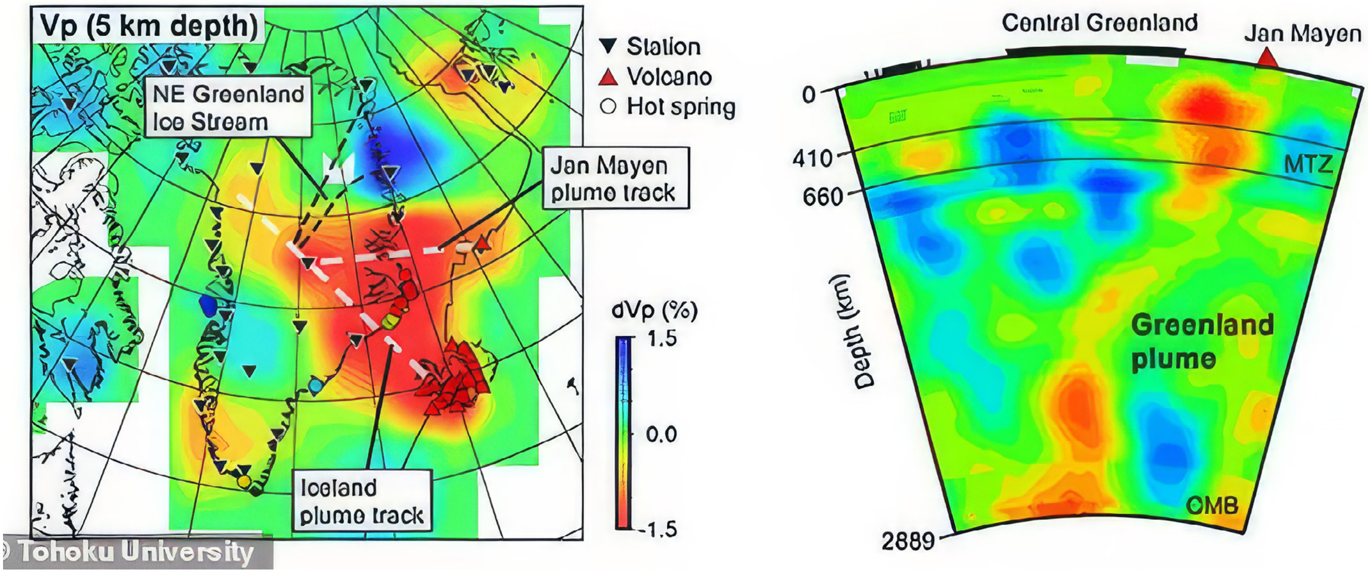


Figure 50

Comparison of the seismic velocity structure and the geothermal heat flux. Blue and red colors indicate high and low velocities of longitudinal waves, respectively. Red shows low-velocity zones that are associated with molten flows from the magma plume. Source: Toyokuni, G., Matsuno, T., & Zhao, D. (2020). P Wave Tomography Beneath Greenland and Surrounding Regions: 1. Crust and Upper Mantle. Journal of Geophysical Research: Solid Earth, 125(12). https://doi.org/10.1029/2020jb019837

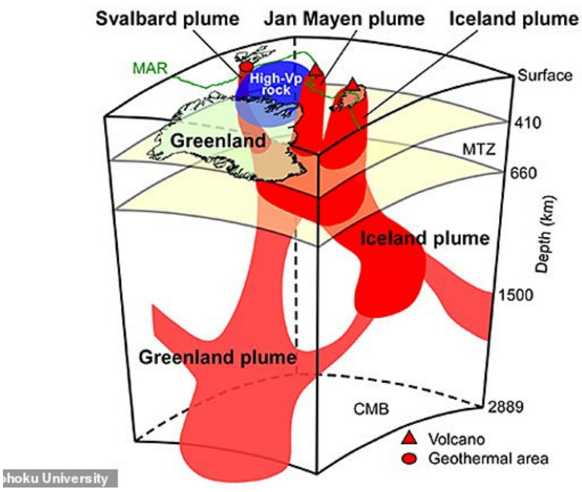


Figure 51

Diagram of the main tectonic features and magmatic plumes beneath Greenland and its surroundings. The Greenland plume has two branches that supply heat to the active zones of Iceland, Jan Mayen, and the geothermal zone of Svalbard. Molten rocks rise from the core-mantle boundary, accelerating ice melting in central Greenland and raising sea levels.
Data source: Toyokuni, G., Matsuno, T., & Zhao, D. (2020).
https://doi.org/10.1029/2020JB019837

[32] Rezvanbehbahani, S., Stearns, L. A., Kadivar, A., Walker, J. D., & van der Veen, C. J. (2017). Predicting the Geothermal Heat Flux in Greenland: A Machine Learning Approach. Geophysical Research Letters, 44(24), 12,271-12,279. https://doi.org/10.1002/2017gl075661

[33] Rysgaard, S., Bendtsen, J., Mortensen, J., & Sejr, M. K. (2018). High geothermal heat flux in close proximity to the Northeast Greenland Ice Stream. Scientific Reports, 8(1344). https://doi.org/10.1038/s41598-018-19244-x

[34] Toyokuni, G., Matsuno, T., & Zhao, D. (2020). P Wave Tomography Beneath Greenland and Surrounding Regions: 1. Crust and Upper Mantle. Journal of Geophysical Research: Solid Earth, 125(12). https://doi.org/10.1029/2020jb019837

Thus, according to the studies by Japanese, Russian, and German scientists, in Greenland, same as in Antarctica, a magma plume is also located in the central part, which is a possible cause of the accelerated sliding of Greenland's glaciers in recent decades.

It is likely that the world's two largest glacial regions, Antarctica and Greenland, are melting not only due to the anthropogenic factor but also additionally due to an increase in geothermal heat from the Earth's interior, and the heat is intensifying, indicated by the exponential trends in glacier melting. This suggests that magma plumes have been active under West Antarctica and Central Greenland since 1995.

The purpose of providing this information is to draw attention to the abnormal amount of accumulated energy inside the planet. The energy level is so high that it has activated magma plumes, which have begun to melt glaciers at an exponential rate. This process is accelerating, which indicates a rise in planetary magmatic activity, which could pose an additional serious threat to human life.

Warming of Lower Layers of the Atmosphere

Unprecedented warming of the lower layers of the atmosphere is a consequence of the world ocean heating. Figure 52 presents a graph illustrating the unprecedented rise in average temperatures worldwide from 1850 to 2023. In 2023, a new historical temperature record was set. According to Samantha Burgess, the Deputy Director of the Copernicus Climate Change Service (CCCS), 2023 became the hottest year, in at least the past 100,000 years[35].

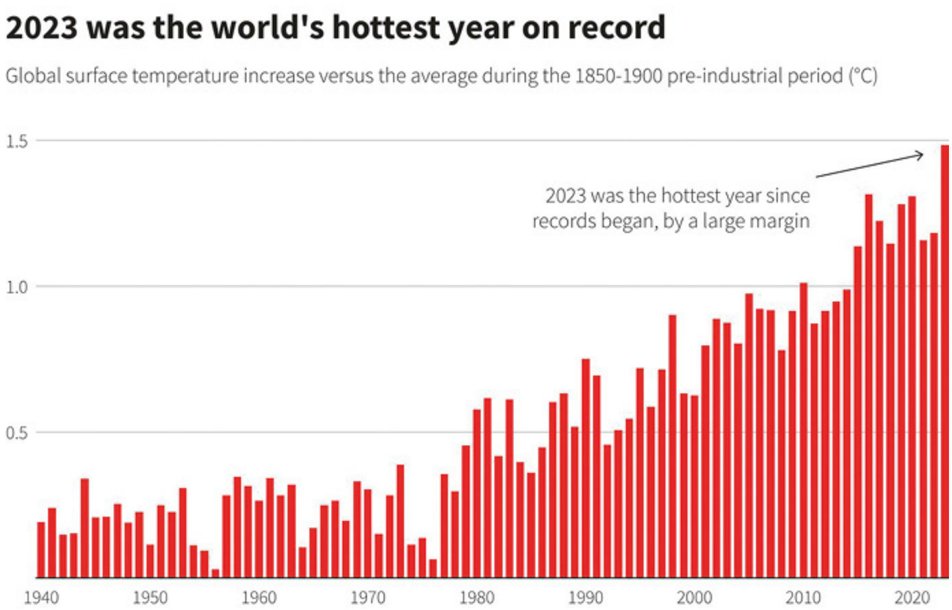


Figure 52

Global surface temperature increase versus the average during the 1850-1900 pre-industrial period (°C)
Source: Copernicus Climate Change Service/ECMWF

[35] Source: https://climate.copernicus.eu/copernicus-2023-hottest-year-record

NASA's top climatologist, Gavin Schmidt, expressed concern about the record-high temperatures in 2023. According to Gavin, these temperatures not only surpassed the previous records, but also indicated the presence of unknown heating processes that exceeded typical long-term trends of previous models. He stated, "*The long term trends we understand, and it's being driven by the greenhouse gases, it's being driven by anthropogenic effects... But what happened in 2023 was that, and then plus something. And that 'plus something' is much larger than we expect, or as yet can explain.*"[36]

Moreover, there is a growing imbalance between the incoming solar radiation and the outgoing radiation from Earth (Figure 53). The graph indicates that the Earth's atmosphere is accumulating energy exponentially. This is due to increased heat from greenhouse gas emissions and, additionally, from the rise of magma from the depths, as well as due to a decrease in the function of the ocean and atmosphere to effectively release heat from the Earth's surface into space. As of March 2023, the annual Earth Energy Imbalance (EEI) was measured at 1.61 watts per square meter, the energy of which is equal to about 13 atomic bombs (those that were detonated in Hiroshima) being dropped on the planet every second.

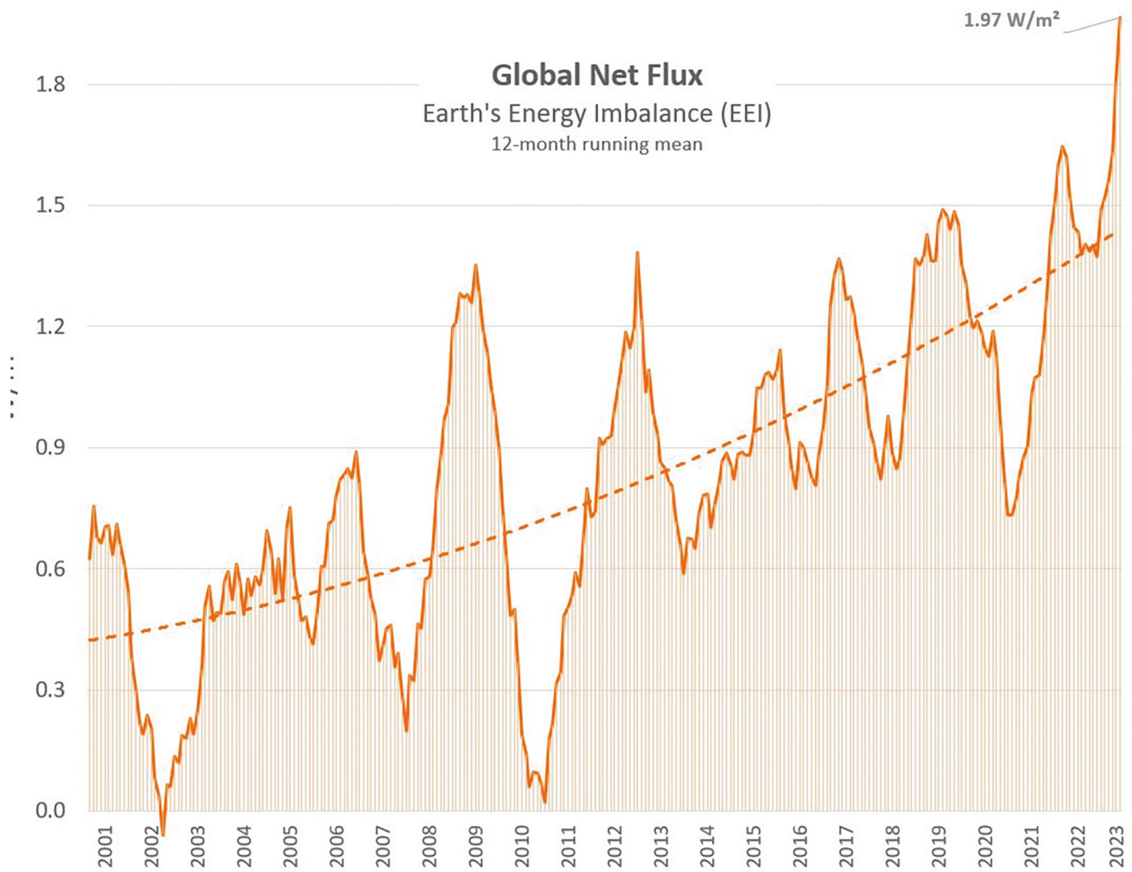


Figure 53

Exponential growth of the Earth Energy Imbalance (EEI), indicating the difference between the incoming solar radiation and the outgoing radiation from all sources. © Leon Simons
Data source: NASA CERES EBAF-TOA All-sky Ed4.2 Net flux, 2000/03-2023/05.

[36] Source: https://phys.org/news/2024-01-driven-mystery-nasa-scientist.html

Changes in Upper Layers of the Atmosphere

It is important to note that the changes are occuring not only in the lower layers of the atmosphere (troposphere), but also in its middle and upper layers. Figure 54 provides a general graphical representation of the atmospheric structure.

The thermosphere, one of the uppermost layers of the atmosphere, has experienced a record decrease in density[37]. Since 2007, scientists have observed an inexplicable reduction in thermospheric density at an altitude of 400 km by 1.7 to 7.4 % over 10 years[38]. This is confirmed by data from over 10,000 satellite orbits that traverse the thermosphere. If the reduction in thermospheric density continues, the risk of satellite collisions or failures can become very high. Moreover, the thermosphere undergoes significant density variations during geomagnetic storms triggered by solar flares. If the thinning of the thermosphere continues at the same rate, combined with a strong solar flare, it could lead to a complete disruption of all navigation and satellite networks, including the Internet.

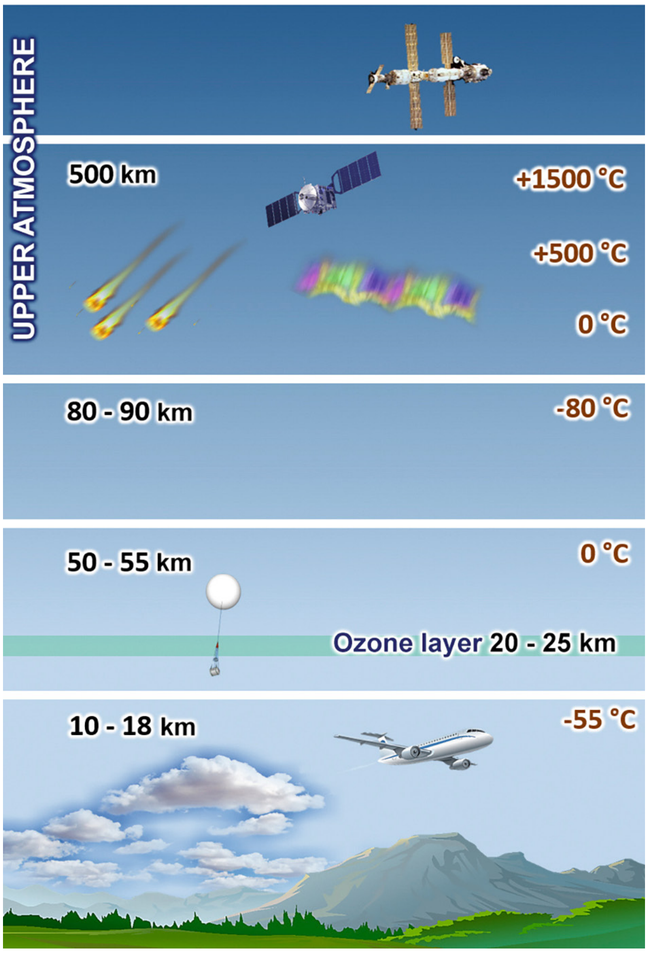


Figure 54

Atmospheric Layers

Changes have also occurred in the mesosphere[39] (at altitudes from 50 to 90 km) and the stratosphere (at altitudes from 18 to 50 km), which have significantly cooled over the past 30 years (Figures 55-56). The decrease in temperature in the middle atmosphere has been established based on observations using various methods[40]. According to data from the years 1980 to 2018, the thickness of the stratosphere decreased by an average of 400 meters[41].

---

[37] Emmert, J. T., Lean, J. L., & Picone, J. M. (2010). Record-low thermospheric density during the 2008 solar minimum. Geophysical Research Letters, 37(12). https://doi.org/10.1029/2010gl043671

[38] Danilov, A.D., Konstantinova, A.V. (2020). Long-Term Variations in the Parameters of the Middle and Upper Atmosphere and Ionosphere (Review). Geomagnetizm i Aeronomija [Geomagnetism and Aeronomy], 60; 397–420. https://doi.org/10.1134/S0016793220040040

[39] Lübken, F.-J., Berger, U., & Baumgarten, G. (2013). Temperature trends in the midlatitude summer mesosphere. Journal of Geophysical Research: Atmospheres, 118(24), 13,347–13,360. https://doi.org/10.1002/2013jd020576

[40] Danilov, A.D., Konstantinova, A.V. (2020). Long-Term Variations in the Parameters of the Middle and Upper Atmosphere and Ionosphere (Review). Geomagnetizm i Aeronomija [Geomagnetism and Aeronomy], 60; 397–420. https://doi.org/10.1134/S0016793220040040

[41] Pisoft, P., Sacha, P., Polvani, L. M., Añel, J. A., de la Torre, L., Eichinger, R., Foelsche, U., Huszar, P., Jacobi, C., Karlicky, J., Kuchar, A., Miksovsky, J., Zak, M., & Rieder, H. E. (2021). Stratospheric contraction caused by increasing greenhouse gases. Environmental Research Letters, 16, 064038. https://doi.org/10.1088/1748-9326/abfe2b

Simultaneously with the decrease in density and temperature, a change in the chemical composition of the atmosphere has been recorded, notably a decrease in the concentration of oxygen in the upper atmosphere (thermosphere) by up to 60%. At an altitude of 130 km in mid-latitudes, the concentration of O2 (molecular oxygen) has decreased by 2-4 times[42,43]. In addition, a decrease in the concentration of atomic oxygen in the upper atmosphere is also observed[44].

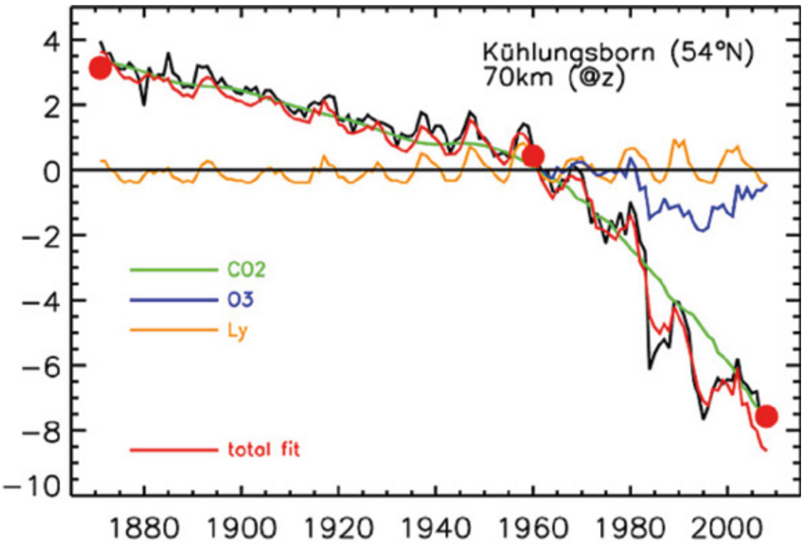


Figure 55

Temperature anomalies in the mesosphere. The temperature in the mesosphere have dropped by approximately 5–7K on pressure altitudes and even more (up to 10–12K) on geometrical altitudes. Source: Lübken, F.-J., Berger, U., & Baumgarten, G. (2013). Temperature trends in the midlatitude summer mesosphere. Journal of Geophysical Research: Atmospheres, 118(24), 13,347–13,360. https://doi.org/10.1002/2013jd020576

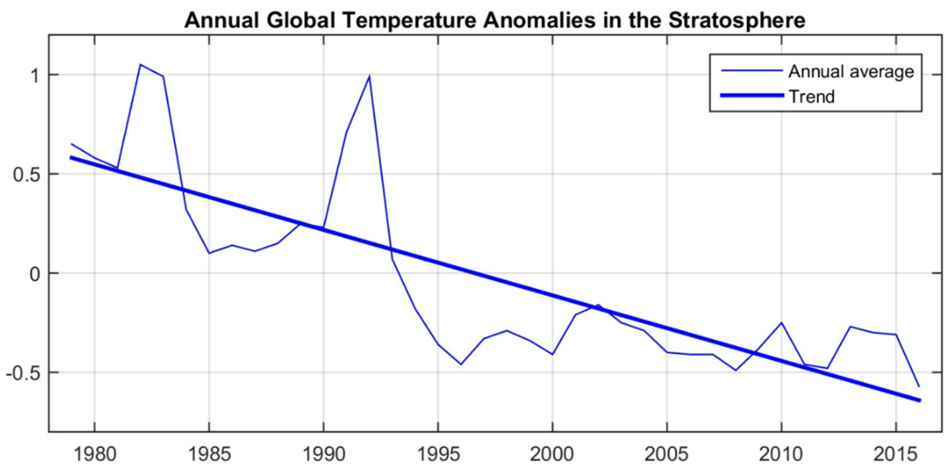


Figure 56

Annual global temperature anomalies in the stratosphere. UAH temperature anomalies (with respect to 1981 - 2010) from NOAA polar orbiting satellites adjusted according to Fu et al. (2004). Source: www.ncdc.noaa.gov

All changes in the middle and upper atmosphere indicate processes of global changes within the Earth's system.

[42]Givishvili, G. V. & Leshchenko, L. N. (2022). Long-term trend of the ionospheric E-layer response to solar flares. Solnechno-Zemnaya Fizika [Solar-Terrestrial Physics], 8(1): 51–57. https://doi.org/10.12737/szf-81202206

[43]Givishvili, G. V. & Leshchenko, L. N. (2022). On the causes of cooling and settling of the middle and upper atmosphere. Izvestija. RAN. Fizika atmosfery i okeana. [News. Russian Academy of Sciences. Atmospheric and Ocean Physics], 58(5), 601-614. https://doi.org/10.31857/S0002351522050042

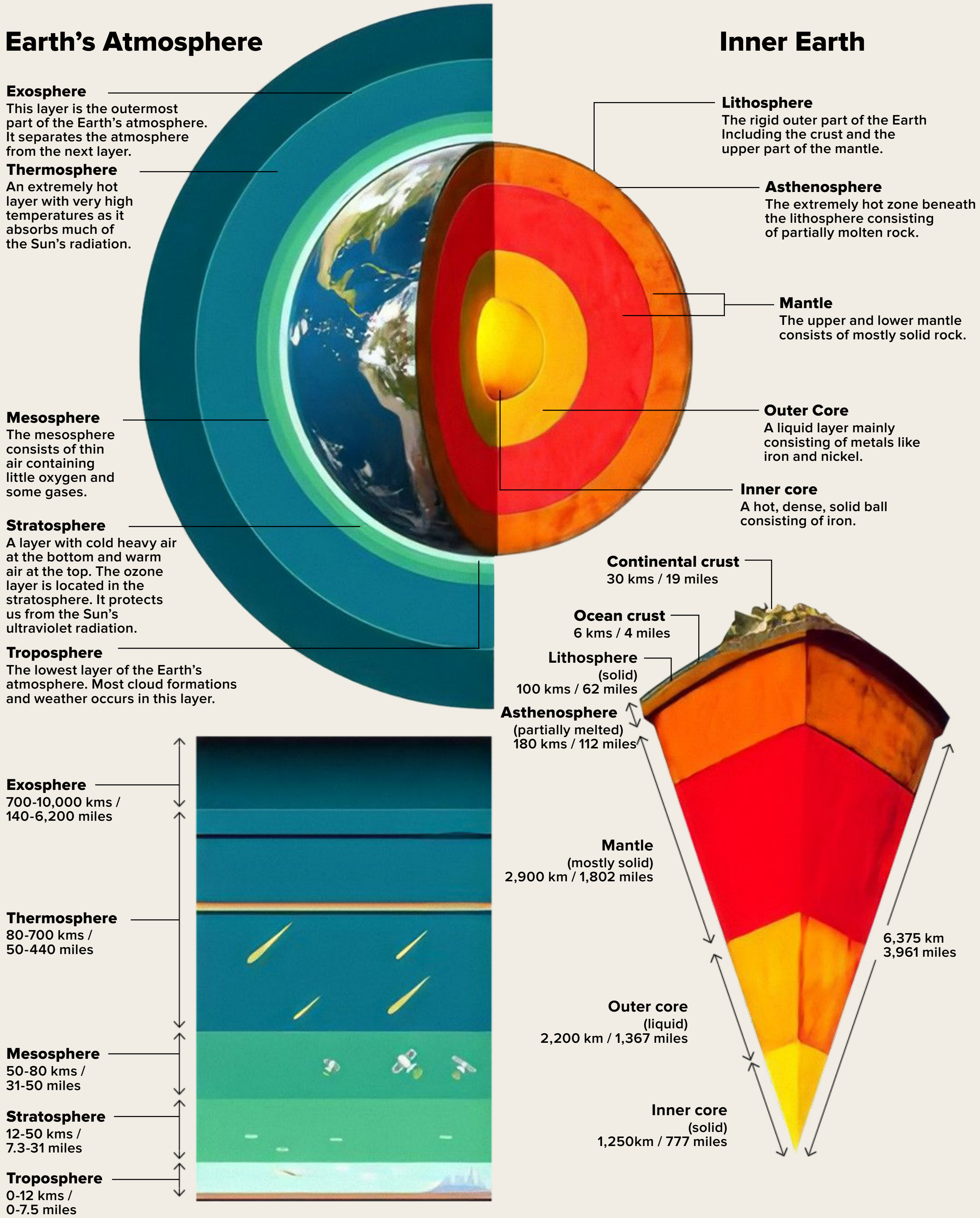
[44]Danilov, A. D., & Konstantinova, A. V. (2014). Reduction of the atomic oxygen content in the upper atmosphere. Geomagnetizm i Aeronomija. [Geomagnetism and Aeronomy], 54(2), 224–229. https://doi.org/10.1134/s0016793214020066

Part 2

CAUSES OF THE GLOBAL CATASTROPHE

Such a rapid and sudden increase in climate, atmospheric, and geodynamic catastrophes worldwide suggests that, in conjunction with the anthropogenic factor, there is a tremendous amount of additional energy inside our planet. Beneath the Earth's crust, there is a complex thermodynamic system that has been functioning for billions of years. Thanks to its stability, life on Earth is possible. However, any changes in one of the underground layers affect the entire system, including the surface layer, where humans live.

THE STRUCTURE OF THE EARTH



Planetary-Scale Changes in 1995

Let's consider changes in the geophysical and geodynamic parameters of the Earth that have occurred since 1995. In that year, scientific laboratories worldwide independently discovered alarming planetary anomalies.

For example, the north magnetic pole, which had previously been constantly drifting at 10 km per year, suddenly increased its speed to 55 km and changed its trajectory towards the Taymyr Peninsula in Siberia (Figures 57-58)[45]. Currently, the north magnetic pole has shifted over a thousand kilometers in the direction of Siberia. Such a rapid movement of the magnetic pole has not been recorded in the last 10,000 years[46].

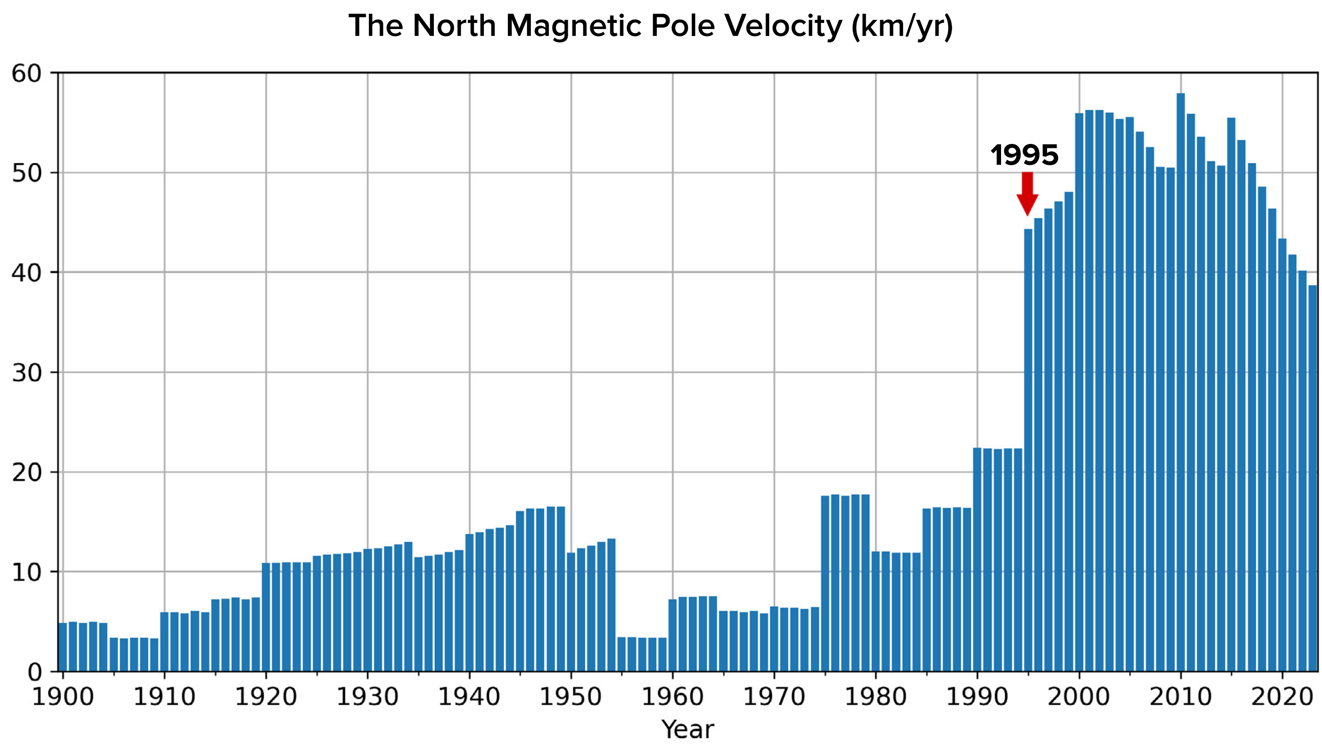


Figure 57

The drift speed of the North Magnetic Pole, km/year.
NOAA data on the position of the North magnetic pole: https://www.ngdc.noaa.gov/geomag/data/poles/NP.xy

[45] Dyachenko, A. I. (2003). Magnetic Poles of the Earth. Moscow: MCCME. 48 p.
[46] Androsova, N. K., Baranova, T. I., & Semykina D.V. (2020). Geological past and present of the Earth's magnetic poles. EARTH SCIENCES/ "Colloquium-journal", 5(57). DOI:10.24411/2520-6990-2020-11388

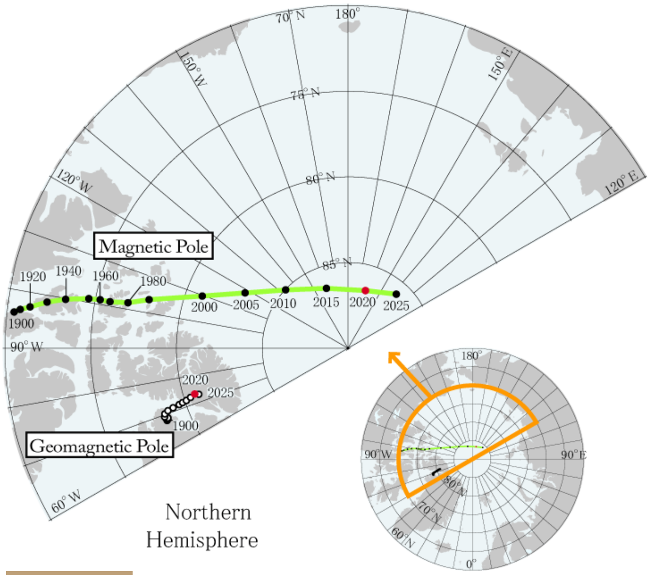


Figure 58

Locations of geomagnetic poles and magnetic poles based on IGRF-13 from 1900 to 2015 by 5 years and at 2020 (red) and 2025 (prediction).
Source: World Data Center for Geomagnetism, Kyoto

In 1995, a disruption in the Earth's rotation was recorded: the direction of the planet's rotation axis changed, and its speed of movement increased 17 times. According to research, "the breakpoint of polar drift in the residual is set in October 1995"[47].

In addition, while scientists had noted the Earth's rotation slowing down before 1995, the acceleration of its rotation jumped abruptly in 1995 and 2016, unprecedented in the history of observations (Figure 59). According to data from the Earth Orientation Center of the Paris Observatory, in 1995 and 2016, the length of day started to decrease by several milliseconds, indicating that the Earth was rotating faster than usual. Note that the length of day is defined as a time it takes the Earth to complete one rotation around its axis.

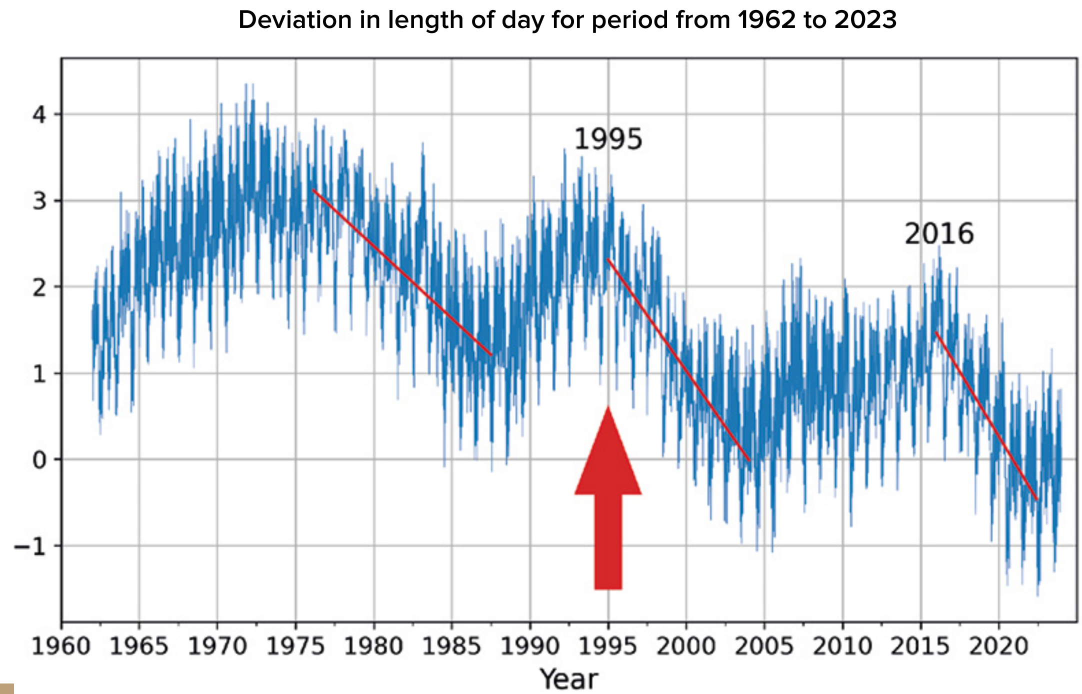


Figure 59

Deviation in the length of day in milliseconds from 1962 to 2023. The red lines on the graph represent trend lines, showing the rate at which days are getting shorter. For instance, the left line is less steep, while the right line, representing acceleration from 2016, is nearly vertical, meaning that days are getting significantly shorter, indicating a faster planet rotation.
Data source: IERS Earth Orientation Center of the Paris Observatory.
Length of day — Earth Orientation Parameters:
https://datacenter.iers.org/singlePlot.php?plotname=EOPC04_14_62-NOW_IAU1980-LOD&id=223

[47]Deng, S., Liu, S., Mo, X., Jiang, L., & Bauer-Gottwein, P. (2021). Polar Drift in the 1990s Explained by Terrestrial Water Storage Changes. Geophysical Research Letters, 48(7). https://doi.org/10.1029/2020gl092114

Thus, in 1995, a sudden and simultaneous change occurred in three geophysical parameters of the Earth:

- the acceleration of the drift of the North Magnetic Pole
- the change in the direction and acceleration of Earth's axis of rotation
- the acceleration of the planet's rotation

Each of these parameters are interrelated with the state of the Earth's core, i.e. the magnetic field is created by the geodynamo in the Earth's core, and the planet's rotation speed and axis are dependent on the Earth's center of mass (inner core). From this, it can be concluded that in 1995, significant and anomalous changes began in the Earth's core, the process of which requires enormous energy.

Weakening of the planet's magnetic field, which protects all living species from deadly cosmic and solar radiation, is also associated with these changes in the Earth's core. Scientists are concerned about the changes occurring in the geomagnetic field: in the last 50 years, there has been a sharp drop in its intensity[48], meaning it is weakening, and according to the forecast, this trend will continue (Figure 60). Over the past century, the magnetic field intensity decreased by 10-15%, and in recent years this process has noticeably accelerated. Moreover, the issue is about the largest weakening over the last 12,000-13,000 years. Weakening of the magnetic field occurs unevenly on the planet. There are zones where the magnetic field has weakened by 30% – this occurs in the southern part of the Atlantic Ocean and in South America, in the area called the South Atlantic Anomaly.

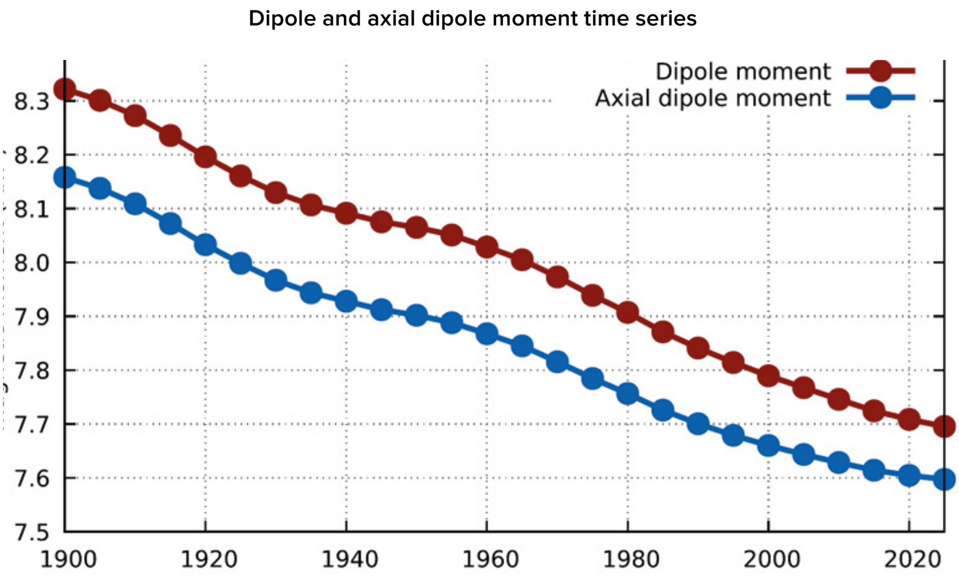


Figure 60

The magnitude of the Earth's dipole magnetic moment from 1900 to 2020. The graph shows how the strength of the Earth's dipole magnetic field has decreased since 1900 and how it is predicted to decrease further. The red color indicates that this decreasing trend has continued through 2020 and is expected to continue into 2025.
Source: Alken, P., Thébault, E., Beggan, C.D. et al. (2021). International Geomagnetic Reference Field: the thirteenth generation. Earth Planets Space 73, 49. https://doi.org/10.1186/s40623-020-01288-x

[48] Tarasov, L. V. (2012) Earth magnetism: A textbook. Dolgoprudny: Intellect Publishing House, 184 p.
Channell, J. E. T., & Vigliotti, L. (2019). The role of geomagnetic field intensity in Late Quaternary evolution of humans and large mammals. Reviews of Geophysics, 57 https://doi.org/10.1029/2018RG000629
Channell, J. E. T., & Vigliotti, L. (2019). The role of geomagnetic field intensity in Late Quaternary evolution of humans and large mammals. Reviews of Geophysics, 57 https://doi.org/10.1029/2018RG000629

Danish scientists came to similar conclusions after analyzing the results of observations of the Earth's magnetic field obtained from the Danish satellite Oersted. In the southern part of the Atlantic Ocean and in the Arctic, they found zones with anomalously low intensity of the magnetic field, which they called "magnetic holes". Scientists believe that the presence of such "holes" pose risks to the operation of navigation equipment on satellites, airplanes, and ships, disruption of radio communications, loss of orientation by migrating birds, and many other problems, even more terrible and unpredictable - up to an increase in cancer, because in the zones of "magnetic holes" the Earth and everything that lives on it become unprotected from cosmic radiation.

An anomalous manifestation of the consequences of the weakening of the magnetic field has been observed in the last few years. Red auroras are recorded in uncharacteristic regions of the Earth and even in places where they have never been before, especially actively since 2023.

According to the current theory, the flows of molten iron moving around the solid core of the planet are responsible for the formation of the magnetic field. In 2013, scientists from the University of Leeds found that all these changes in the magnetic field began to occur due to the acceleration of the flow of liquid iron in the Earth's outer core[49] (Figure 61), which likely began in 1995.

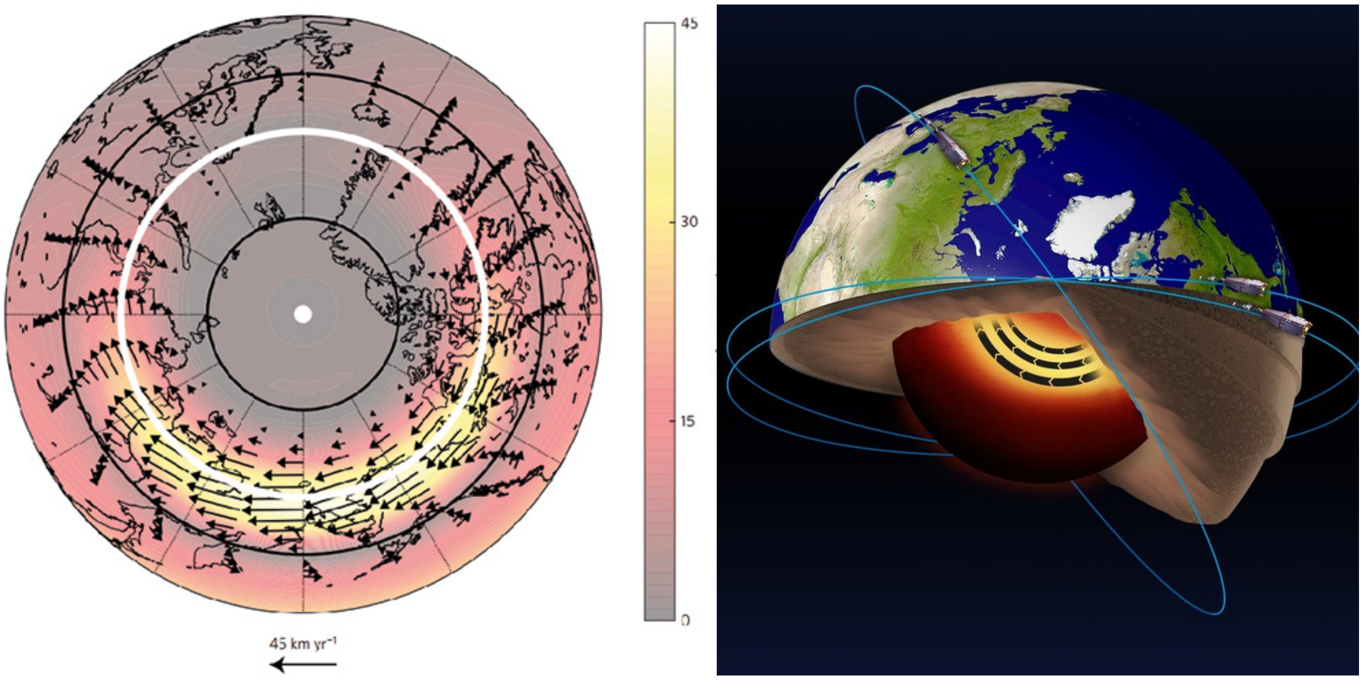


Figure 61

Analysis of ESA Swarm satellite data has revealed the presence of a jet stream in the liquid iron part of the Earth's core at a depth of 3000 km below the surface, and also that this jet stream is accelerating. Source: ESA
Livermore, P. W., Hollerbach, R., & Finlay, C. C. (2017). An accelerating high-latitude jet in Earth's core. Nature Geoscience, 10, 62–68. https://doi.org/10.1038/ngeo2859

[49]Livermore, P. W., Hollerbach, R., & Finlay, C. C. (2017). An accelerating high-latitude jet in Earth's core. Nature Geoscience, 10, 62–68. https://doi.org/10.1038/ngeo2859

Displacement of the Earth's Core in 1998

In 1997-1998, by studying the Earth's center of mass via satellite, scientists recorded an unparalleled phenomenon — a displacement of the Earth's inner core[50]. As a result, the planet's core shifted northward, along the line from West Antarctica to Western Siberia, towards the Taimyr Peninsula, Russia (Figure 62).

At the same time, four different research teams independently recorded abnormal changes in various geophysical parameters of the Earth, evidencing this event. According to the satellite data, a team of authors from Moscow State University and the Institute of Physics of the Earth of the Russian Academy of Sciences registered a displacement in the Earth's center of mass in 1998[51] (Figure 63). During the same period, the International Earth Rotation Service (IERS) recorded a sharp acceleration of the planet's rotation (Figure 64). At the same time, at the Medicina station in Italy, scientists recorded a sudden shift in gravity[52] (Figure 65). Simultaneously, a sharp change in the Earth's shape[53] was observed (Figure 66), registered using a laser rangefinder system from US satellites. The planet began to expand abnormally in the equator area, although before, the trend was the opposite.

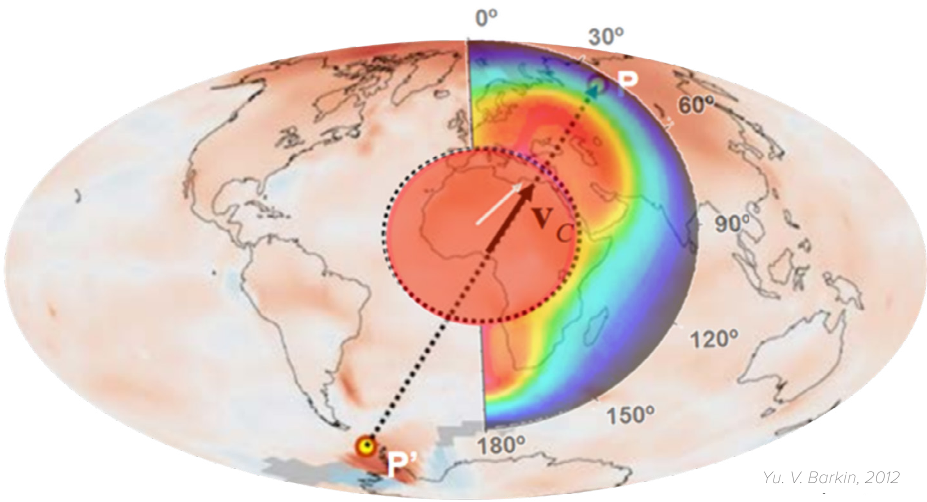
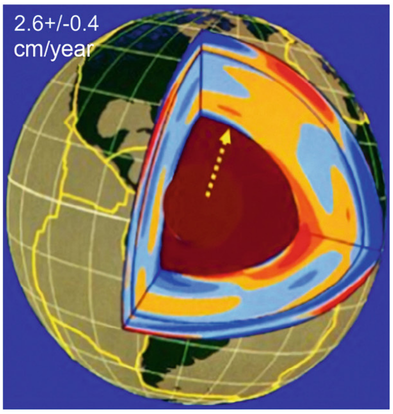


Figure 62

Displacement of the Core in 1997-1998 and Thermal Waves in Magma Caused by the Core Shift. (Barkin, Yu. V.)
The map depicts the displacement vector of the inner core from West Antarctica to Western Siberia, towards the Taimyr Peninsula. The scheme is overlaid on a map of atmospheric thermal anomalies.
Source: Geophysical implications of relative displacements and oscillations of the Earth's core and mantle. Presentation by Yu.V. Barkin, Moscow, IFZ, OMTS. September 16, 2014.

[50] Barkin, Y. V. (2011). Sinhronnye skachki aktivnosti prirodnyh planetarnyh processov v 1997-1998 gg. i ih edinyj mekhanizm [Synchronous spikes in the activity of natural planetary processes in 1997-1998 and their unified mechanism]. in Geologiya morej i okeanov: Materialy XIX Mezhdunarodnoj nauchnoj konferencii po morskoj geologii [Geology of Seas and Oceans: Materials of the XIX International Scientific Conference on Marine Geology]. Moscow: GEOS, 5, 28-32
Smolkov, G. Ya. (2018). Exposure of the solar system and the earth to external influences. Physics & Astronomy International Journal, 2(4), 310–321. https://doi.org/10.15406/paij.2018.02.00104
[51] Zotov, L. V., Barkin, Y. V. & Lyubushin, A. A. (2009). Dvizhenie geocentra i ego geodinamika [The motion of the geocenter and its geodynamics]. In 3rd. conf. Space geodynamics and modeling of global geodynamic processes, Novosibirsk, September 22-26, 2009, Siberian Branch of the Russian Academy of Sciences. (pp. 98-101). Novosibirsk: Geo.
[52] Romagnoli, C., Zerbini, S., Lago, L., Richter, B., Simon, D., Domenichini, F., Elmi, C., & Ghirotti, M. (2003). Influence of soil consolidation and thermal expansion effects on height and gravity variations. Journal of Geodynamics 35(4-5), 521–539. https://doi.org/10.1016/S0264-3707(03)00012-7
[53] Cox, C., & Chao, B. F. (2002). Detection of a large-scale mass redistribution in the terrestrial system since 1998. Science, 297(5582), 831–833. https://doi.org/10.1126/science.1072188



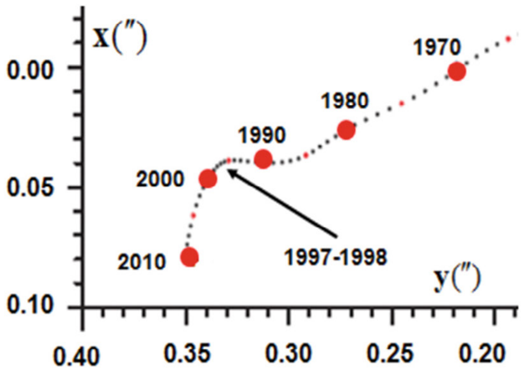
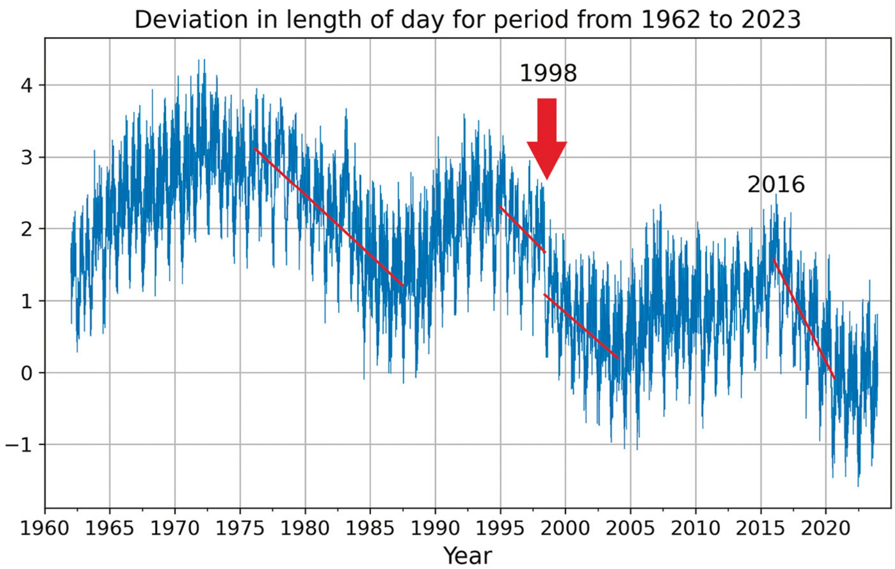


Figure 63

The internal structure of the Earth; the direction of the secular drift of the Earth's center of mass and the trajectory of its pole across the Earth's surface in 1990-2010 with an almost 90 degrees turn in 1997-1998 towards the Taimyr Peninsula (Barkin Yu.V., Klige R.K., 2012)

Figure 64

In 1998, the International Earth Rotation and Reference Systems Service (IERS) recorded a sharp acceleration in Earth's rotation. Data source: Earth Orientation Center, Paris Observatory. Length of day - Earth Orientation Parameters: https://datacenter.iers.org/singlePlot.php?plotname=EOP-C04_14_62-NOW_IAU1980-LOD&id=223



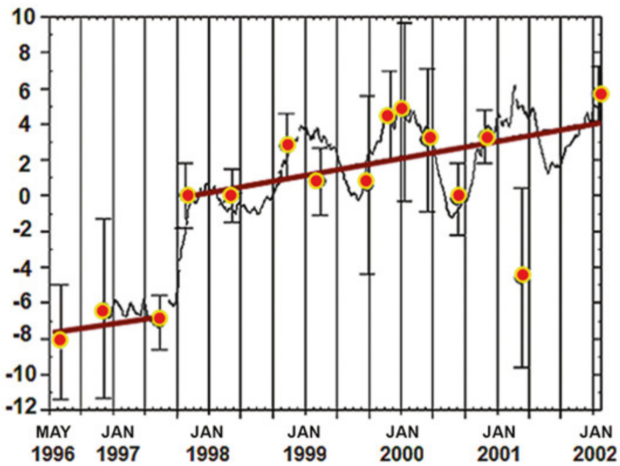


Figure 65

The gravimetric station in Medicina, Italy, recorded a sudden jump in Earth's gravity in 1997-1998.
Source: Romagnoli, C., Zerbini, S., Lago, L., Richter, B., Simon, D., Domenichini, F., Elmi, C., & Ghirotti, M. (2003). Influence of soil consolidation and thermal expansion effects on height and gravity variations. Journal of Geodynamics, 35(4-5), 521–539. https://doi.org/10.1016/s0264-3707(03)00012-7

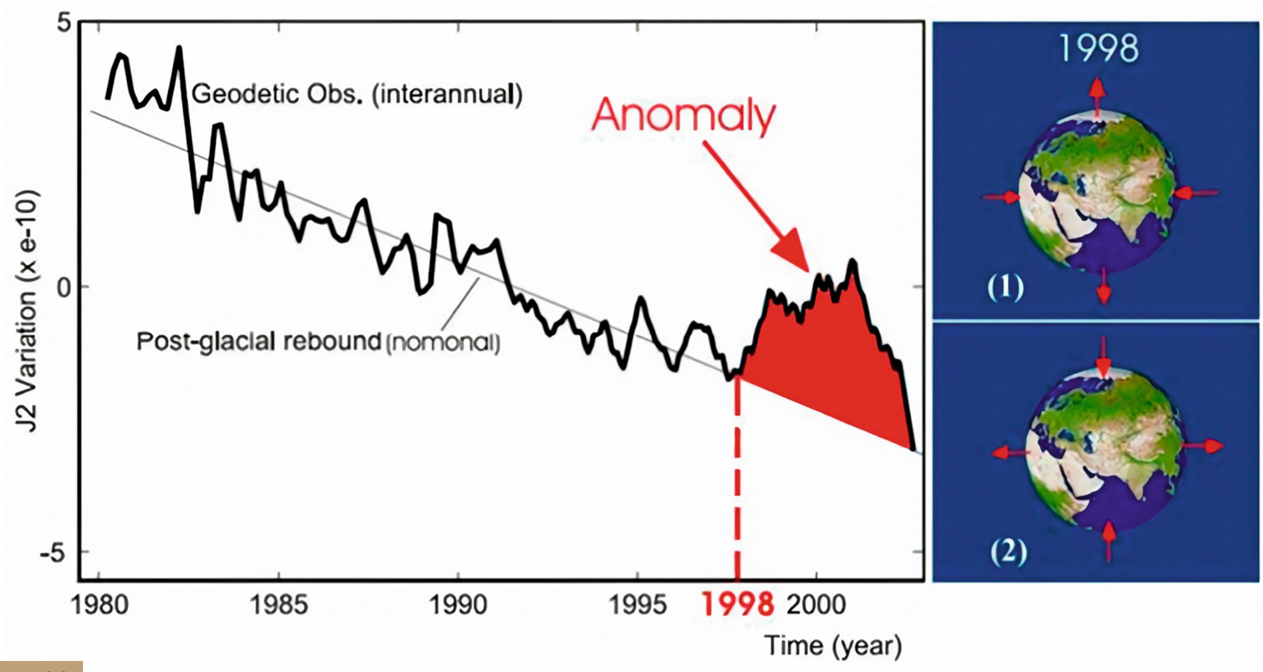


Figure 66

In 1998, according to the data obtained by the laser rangefinder system Doppler Orbitography and Radiopositioning Integrated by Satellite (DORIS), France, a sharp change in the Earth's shape was observed: it expanded in volume.
Source: Cox, C., & Chao, B. F. (2002). Detection of a large-scale mass redistribution in the terrestrial system since 1998. Science, 297(5582), 831–833. https://doi.org/10.1126/science.1072188

According to the Doctor of Physical and Mathematical Sciences, Professor Yuri Barkin, Doctor of Technical Sciences, Professor Gennadi Smolkov[54], Doctor of Geographical Sciences, Professor Mikhail Arushanov[55], Academician of the Russian Academy of Sciences and Honored Professor of Lomonosov Moscow State University, Doctor of Geological and Mineralogical Sciences Victor Khain[56], and many other researchers, the displacement of the core resulted in changes in all the Earth's shells.

A considerable displacement of the Earth's core, which is comparable in size to the Moon, raises a question about the nature and scale of the influence or the forces capable of causing such changes in the internal structure of the planet.

[54] Barkin, Yu. V. & Smolkov, G. Ya. (2013). Abrupt changes in the trends of geodynamic and geophysical phenomena in 1997-1998. In All-Russian Conf. on Solar-Terrestrial Physics, dedicated to the 100th anniversary of the birth of a corresponding member of the Russian Academy of Sciences Stepanov V.E. (September 16-21, 2013, Irkutsk), Irkutsk, 2013.

[55] Arushanov, M. L. (2023). Causes of Earth climate change, as a result of space impact, dispelling the myth about anthropogenic global warming. Deutsche Internationale Zeitschrift Für Zeitgenössische Wissenschaft, 53, 4–14. https://doi.org/10.5281/zenodo.7795979

[56] Khalilov, E. (Ed.). (2010). Global changes of the environment: Threatening the progress of civilization. GEOCHANGE: Problems of Global Changes of the Geological Environment, 1, London, ISSN 2218-5798.

Interconnections Between Geodynamic and Climatic Processes

Summarizing the above facts, it can be stated that in the last few decades, the following anomalous changes have started occurring in various shells of the Earth:

1. Change in the planet's geophysical parameters

Abnormal acceleration of the Earth's rotation since 1995.

Sharp displacement and acceleration of the drift of the planet's rotation axis in 1995.

2. Change in geomagnetic parameters of the Earth's core

Sudden acceleration of the north magnetic pole drift in 1995.

Decrease in magnetic field intensity; increase in the area of magnetic anomalies.

3. Core

Acceleration of the liquid iron flow in the outer core since 1995.

In 1997-1998, a sharp shift of the inner core along the line from West Antarctica to Western Siberia, towards the Taimyr Peninsula.

4. Mantle

Drastic increase in deep-focus earthquakes at depths between 300 and 750 km since 1995.

5. Lithosphere

Increase in seismic activity since 1995; emergence of earthquakes in regions where they have never been recorded before.

Abnormal volcanic and magmatic activity; changes in the composition of erupting lavas.

Accelerated melting of glaciers from the bottom up due to increased heat coming from the interior, above magma plumes since 1995.

6. Ocean

Unprecedented increase in ocean surface temperatures and ocean water evaporation.

7. Atmosphere

Cooling of the stratosphere and mesosphere; thinning of the thermosphere; decrease in concentrations of atomic and molecular oxygen in different layers of the atmosphere. Increase in global air temperatures in the troposphere.

Extreme increase in the power and number of hurricanes, floods, wildfires, droughts, and tornadoes.

This report presents a model illustrating the interplay between geodynamic and climatic processes. The model was developed to elucidate the concurrent disruption of equilibrium across all layers of the Earth and the emergence of anomalies in the planet's geodynamics. This phenomenon is accompanied by a heightened frequency of extreme climatic events on the Earth's surface. An essential aspect of the model underscores the linkage of these processes with the threat posed by anthropogenic activities.

Apparently, the core is currently experiencing an imbalance and is heating up, which was manifested in an acceleration of the liquid iron flow in the outer core in 1995 and a displacement of the inner core in 1998. This acceleration of the liquid iron flow in the outer core was the very reason why the north magnetic pole began to shift much faster.

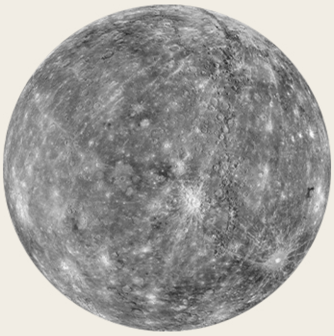
According to the hypothesis, the core's displacement causes acceleration of the planet's rotation; the planet's centrifugal force and deformation along the equator is increasing. Due to the increase in centrifugal force, magma begins to sharply rise in the mantle, towards the Earth's surface, eroding and heating the lithosphere from the inside more than usual. The oceanic crust is thinner; therefore, it is more susceptible to the pressure from rising magma. Presumably, magma is penetrating everywhere throughout the ocean floor. The thermal content of ocean waters is growing, and anomalous areas with increased water temperature appear in the ocean. Presumably, it is the rising magma that results in an increase of geothermal flow from the planet's interior and a rise of magma plumes under the glaciers of West Antarctica and central Greenland, accelerating the melting of glaciers from the bottom up, in conjunction with greenhouse gas emissions. Groundwater temperatures are rising in Western Siberia and other regions with thin Earth's crust. It is clear that the rise of magma is causing activation of volcanic, seismic, and tectonic processes, and it also likely increases the frequency and scale of catastrophic climatic events such as abnormal precipitation, increased frequency of hurricanes, floods and wildfires. According to the model, as a result of the changes in the core, the magnetic field has been intensively weakening, which causes changes in the upper layers of the atmosphere, its thinning and cooling, and a decrease in oxygen concentrations due to more intense penetration of the solar wind. These factors, in turn, likely manifest themselves in abnormal and atypical auroras.

Changes on Other Planets of the Solar System

According to observations, on other planets of the solar system, even on “dead” planets, the same processes in their interiors began to occur synchronously with the Earth: there has been an emergence of volcanic activity, seismic activity as well as magnetic anomalies. According to the hypothesis described in this report, this can only happen in the case of similar changes in the cores of the planets of the solar system just as it happens on the Earth.

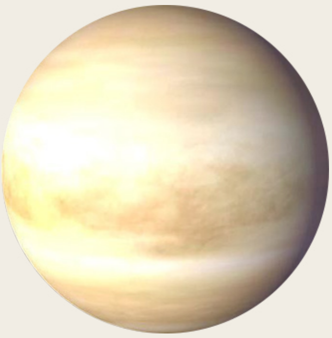
As noted earlier, colossal volumes of additional energy are required to alter the position of the inner core and accelerate the flow of iron in the outer core. This energy likely began to enter the Earth’s system in significant amounts in 1995. Thus, synchronous changes on other planets of the solar system suggest that there is some external cosmic influence affecting the cores of the planets.

The infographic images below show the synchronous changes that have occurred on the solar system planets and their satellites in recent decades. Links to relevant scientific sources are provided to confirm and supplement this information.



MERCURY

2011-2015 19 SURFACE CHANGES ON MERCURY DUE TO ENDOGENIC ACTIVITY
DOI: 10.1029/2022GL100783



VENUS

2006-2012 INTENSIFICATION OF WINDS
DOI: 10.1016/j.icarus.2013.05.018

2006-2009 MAGMATIC HOTSPOTS DISCOVERED
DOI: 10.1126/science.1186785

2012-2018 VOLCANIC ACTIVITY INCREASES
DOI: 10.1051/0004-6361/201833511

2020 RESEARCH CONDUCTED IN 2020 CONFIRMED THAT VENUS IS CURRENTLY VOLCANICALLY ACTIVE
DOI: 10.1126/sciadv.aax7445
DOI: 10.3847/PSJ/ab8faf
DOI: 10.1038/s41550-020-1174-4

EARTH

1995 ACCELERATED DRIFT OF THE EARTH'S NORTH MAGNETIC POLE
DOI: 10.19080/IJESNR.2022.29.556271

SINCE 1995 ATLANTIC HURRICANE ACTIVITY HAS INCREASED SIGNIFICANTLY
DOI: 10.1038/nature06422

1997 (FEBRUARY 28, M7, AND MAY 10, M6) EARTHQUAKES IN IRAN RESULTED IN OVER 2,600 DEATHS

1998 (FEBRUARY 4 AND MAY 30) EARTHQUAKES IN AFGHANISTAN — OVER 7,000 DEATHS

1998 THE MOST SEVERE FLOOD IN THE HISTORY OF BANGLADESH — 65 PERCENT OF THE COUNTRY'S TERRITORY FLOODED

1998 MALPA LANDSLIDE, INDIA

MAY 26, 1998 EXTREME HEATWAVE REACHING 50°C IN INDIA

MAY 30, 1998 MAGNITUDE 7 EARTHQUAKE IN AFGHANISTAN

JULY 17, 1998 MAGNITUDE 7 EARTHQUAKE AND 15-METER TSUNAMI IN PAPUA NEW GUINEA
https://pubs.usgs.gov/publication/70022643

JULY 1998 HEAVY RAINS IN CHINA DESTROYED 2.9 MILLION HOMES AND DEVASTATED OVER 9 MILLION HECTARES OF CROPS
https://earth.esa.int/web/earth-watching/natural-disasters/floods/content/-/asset_publisher/zaoP2lUloYKv/content/flood-yangtze-china-ju-ly-1998/

1997-1998 SHIFT OF THE PLANET'S CORE
Zotov L.V., Barkin Yu.V., Lyubushin A.A. (2009)

1998 EARTH'S DYNAMIC OBLATENESS (J2 COEFFICIENT) CHANGE
DOI: 10.1126/science.1072188

2004 TSUNAMI IN INDONESIA
DOI:10.1785/gssrl.76.3.312 and DOI:10.1186/s40562-014-0015-7

2005 HURRICANE SEASON WITH THE HIGHEST ACCUMULATED CYCLONE ENERGY (ACE) INDEX
DOI:10.1175/2007MWR2074.1

2005 HURRICANE KATRINA
DOI:10.1257/jep.22.4.135

EARTH

2008 EARTHQUAKE IN CHINA
DOI:10.19044/esj.2023.v19n13p49

2010 EARTHQUAKE IN HAITI
DOI:10.1029/2011GL049799

2011 EARTHQUAKE IN JAPAN. CO-SEISMIC GRAVITY CHANGE ALONG THE JAPANESE EAST COAST WAS DETECTED
DOI:10.1016/j.geog.2015.10.002

1979-2017 INTENSIFICATION IN HURRICANE ACTIVITY
DOI:10.1073/pnas.1920849117

2012-2017 ANOMALIES IN EARTH'S ROTATION SPEED, WHICH CORRELATE WITH STRONG EARTHQUAKES
DOI:10.1016/j.geog.2019.06.002

2020 THE MOST ACTIVE HURRICANE SEASON IN THE NORTH ATLANTIC ON RECORD (IN TERMS OF QUANTITY)
DOI:10.3390/atmos13121945

2016-2023 ACCELERATION OF THE EARTH'S ROTATION
datacenter.iers.org/singlePlot.php?plotname=EOP-C04_14_62-NOW_IAU1980-LOD&id=223

2021-2022 ANOMALOUS CHEMICAL COMPOSITION AND PROPERTIES OF LAVA. IT COMES FROM GREAT DEPTHS. ABNORMALLY FAST ERUPTIONS
DOI:10.1038/s41586-022-04981-x
DOI:10.1038/s41467-022-30905-4 DOI:10.1029/2023GL102763

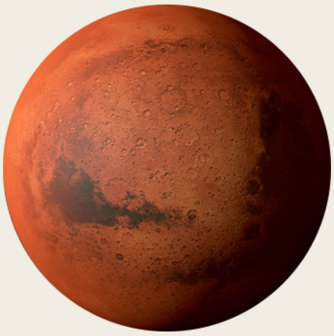
MOON

1997-1998 LUNAR CORE DISPLACEMENT
DOI:10.18698/2308-6033-2014-10-1335

2022 THERMAL ANOMALY IS DETECTED IN THE COMPTON–BELKOVICH REGION
DOI:10.1038/s41586-023-06183-5

2023 THERMAL ANOMALY OF LUNAR SOIL AT THE SOUTH POLE
isro.gov.in/Ch3_first_observation_ChaSTE_Vikram_Lander.html

AUGUST 26, 2023 LUNAR QUAKE DETECTED
https://www.isro.gov.in/Ch3_ILSA_Listens_Landing_Site.html



MARS

2003-2006 **ACTIVE METHANE EMISSIONS DETECTED FROM MARS' INTERIOR**
DOI:10.1126/science.1165243

2014-2020 **ACTIVE METHANE EMISSIONS DETECTED FROM MARS' INTERIOR**
DOI:10.1029/2021EA001915

2004 **A NEW TYPE OF MARTIAN AURORA WAS OBSERVED FOR THE FIRST TIME IN THE SOUTHERN HEMISPHERE**
DOI:10.1038/nature03603

2005 **SUDDEN SHRINKAGE OF THE SOUTH POLAR CAP**
DOI:10.1007/978-1-4614-4608-8_10

2014-2021 **278 DISCRETE POLAR AURORAS WERE RECORDED ON MARS**
DOI:10.1029/2021JA029495

2015 **DISCOVERY OF PROTON AURORAS**
DOI:10.1038/s41550-018-0538-5

2018 **LIQUID WATER FOUND BENEATH THE SOUTH POLE ICE CAP**
DOI:10.1029/2018GL080985

2019-2021 **OVER 1,300 MARSQUAKES OCCURRED**
DOI:10.1029/2022JE007503

2019-2020 **LOW-FREQUENCY REPETITIVE MARSQUAKES LINKED TO VOLCANIC ACTIVITY UNDER CERBERUS FOSSAE**
DOI:10.1038/s41467-022-29329-x

2022 **GEOPHYSICAL EVIDENCE FOR A GIANT MANTLE PLUME UNDERNEATH ELYSIUM PLANITIA**
DOI:10.1038/s41550-022-01836-3

MAY 4, 2022 **THE LARGEST M4.7 MARSQUAKE DETECTED**
DOI:10.1029/2023GL103619

2022 **POLAR AURORAS ENCOMPASSED HALF OF THE PLANET**
twitter.com/HopeMarsMission/status/1519311155768008704

JUPITER

1992-1996, 2005-2007 A MAGNETIC ANOMALY INTENSIFIED IN JUPITER'S NORTHERN HEMISPHERE
DOI:10.1029/2008JA013185

2000-2001 JUPITER'S INTERNAL HEAT INCREASED BY 37% SINCE 1980 WHEN THE VOYAGER'S RESEARCH WAS DONE. AND THIS INTERNAL HEATING IS GREATER THAN THE ENERGY RECEIVED FROM THE SUN
DOI:10.1038/s41467-018-06107-2

2005-2006 FOR THE FIRST TIME, FORMED ANOTHER POWERFUL RED SPOT – JUNIOR
DOI:10.1088/0004-6256/135/6/2446

2009-2020 THE WIND SPEEDS WITHIN THE GREAT RED SPOT INCREASED BY 8%
DOI:10.1029/2021GL093982

2012 JUPITER'S UPPER-ATMOSPHERIC ABNORMAL HEATING OVER THE GREAT RED SPOT IS DRIVEN FROM BELOW
DOI:10.1038/nature18940

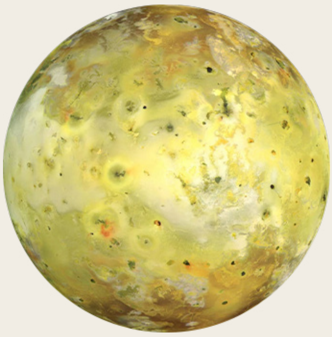
2016-2020 ANOMALOUS LIGHTNINGS WERE RECORDED IN THE UPPER LAYERS OF THE ATMOSPHERE
DOI:10.1029/2020JE006659

2017 STRONG EQUATORIAL JET DETECTED
DOI:10.1051/0004-6361/202141523

2017 JUPITER'S MAGNETIC FIELD UNDERWENT GLOBAL CHANGES COMPARED TO THE 1980S, ESPECIALLY IN THE REGION OF THE GREAT BLUE SPOT
DOI:10.1038/s41550-019-0772-5

2019 ANOTHER HURRICANE APPEARED AT THE SOUTH POLE, WHEREAS THERE HAD ALWAYS BEEN ONLY 5 HURRICANES THERE
nasa.gov/missions/juno/nasas-juno-navigators-enable-jupiter-cyclone-discovery

2022 NARROW EQUATORIAL STRATOSPHERIC JET DETECTED WITH WIND SPEEDS OF ABOUT 515 KM/H
DOI:10.1038/s41550-023-02099-2



IO

IN THE 2000S THE ERUPTION CYCLE OF IO'S LARGEST VOLCANO, LOKI, WAS DISRUPTED, IT BEGAN TO ERUPT MORE OFTEN
EPSC Abstracts Vol. 13, EPSC-DPS2019-769-1, 2019

2003-2005 ERUPTIONS OF 4 NEW YOUNG VOLCANOES
DOI:10.1016/j.icarus.2015.12.054

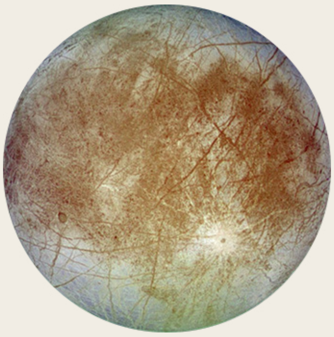
2000, 2006, 2007 MAJOR ERUPTIONS OF TVASHTAR VOLCANO
DOI:0.1126/science.1147621

2013-2018 NEW UNIQUE HOT SPOTS AND ERUPTIONS DISCOVERED
DOI:10.3847/1538-3881/ab2380
DOI:10.1016/j.icarus.2014.06.006
DOI:10.1016/j.icarus.2014.06.016
DOI:10.1016/j.icarus.2016.06.019

2016-2022 SEVEN NEW, MOST ENERGETIC VOLCANIC EVENTS DISCOVERED
DOI:10.3847/PSJ/acf57e

2022 POWERFUL VOLCANIC ERUPTIONS
DOI:10.1029/2023JE007872

2022 SUBSURFACE MAGMA OCEAN DISCOVERED
DOI:10.3847/PSJ/ac9cd1



EUROPA

1997 FIRST EVIDENCE OF A PLUME WHICH EMERGED DUE TO THE HEATING
DOI:10.1038/s41550-018-0450-z

2016-2017 WATER VAPOR ABOVE THE SURFACE IS DISCOVERED
DOI:10.1038/s41550-019-0933-6

2018 SURFACE THERMAL ANOMALIES DETECTED USING ALMA OBSERVATIONS
DOI:10.3847/1538-3881/aada87

2022 ENDOGENOUS CARBON DIOXIDE DETECTED ON EUROPE
DOI:10.1126/science.adg4270

SATURN

2004-2006 LIGHTNING STORMS OBSERVED
DOI:10.1016/j.icarus.2007.03.035

2004 "HOT POINT" DISCOVERED AT SATURN'S SOUTH POLE
DOI:10.1126/science.1105730

2006 WIDE AREA OF AURORA
science.nasa.gov/resource/saturns-polar-aurora

2007-2010 A CHAIN OF 23-26 CYCLONES
DOI:10.1016/j.icarus.2013.10.032

2010 A GREAT WHITE PLANET-ENCIRCLING STORM OCCURRED. THE CONSEQUENCES MANIFESTED THEMSELVES WITHIN 3 YEARS
DOI:10.1016/j.icarus.2012.12.013
DOI:10.1038/s41550-017-0271-5

2011 THE ORIGIN AND EVOLUTION OF A STRATOSPHERIC VORTEX
DOI:10.1016/j.icarus.2012.08.024

2018 A NEW INTERMEDIATE TYPE OF STORMS
DOI:10.1038/s41550-019-0914-9

2020 A CONVECTIVE STORM FOR THE FIRST TIME CLOSE TO POLAR LATITUDES, AND A NEW EPISODE OF STORMS THIS YEAR
DOI:10.1029/2021GL092461

URANUS

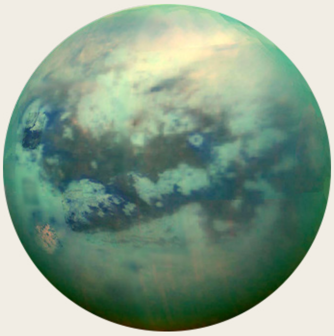
1999, 2004, 2005, 2011 DETECTION OF BRIGHT CLOUD FEATURES
DOI:10.1016/j.icarus.2004.11.016
DOI:10.1016/j.icarus.2012.04.009

2014 RECORD-BREAKING STORM ACTIVITY
DOI:10.1016/j.icarus.2014.12.037

2014 MAXIMUM MEASURED TEMPERATURES FOR THE ATMOSPHERE BETWEEN INDIVIDUAL OBSERVATIONS
DOI:10.1098/rsta.2018.0408

2014 THE NUMBER OF CLOUD PATTERNS SIGNIFICANTLY GREATER THAN IN PREVIOUS YEARS
DOI:10.1016/j.icarus.2015.05.029

2021, 2022 INTENSIFICATION OF THE NORTHERN POLAR CYCLONE
DOI:10.1029/2023GL102872



TITAN

1995, 2004, 2008 SUDDEN CLOUD OUTBURST — STORM ACTIVITY
DOI:10.1038/26920 DOI:10.1038/nature08193
DOI:10.1016/j.icarus.2005.12.021

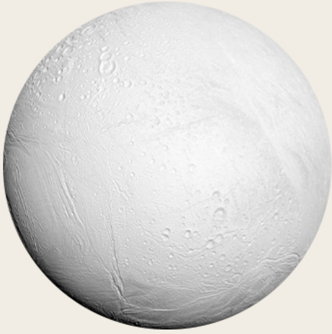
2009 OBSERVATION OF DUST STORMS
DOI:10.1038/s41561-018-0233-2

2009 A POLAR VORTEX FORMED, WHICH IN 2010-2011 PRODUCED A MESOSPHERIC HOT-SPOT AND CAUSED EXTREME COOLING OF THE MESOSPHERE
DOI:10.1038/s41467-017-01839-z

2010 STORM ARROW NEAR THE EQUATOR
DOI:10.1038/ngeo1219

2012 EVIDENCE FOR VOLCANISM THAT MAY BE HAPPENING NOW
DOI:10.1029/2019JE006036

2016 THE FIRST DOCUMENTED RAINFALL EVENT (METHANE RAIN), COVERING AN AREA OF 120,000 KM^2
DOI:10.1029/2018GL080943



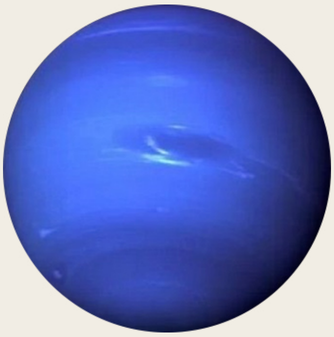
ENCELADUS

2005 DISCOVERY OF A SOUTH POLAR HOT SPOT
DOI:10.1126/science.1121661

2005 HEAT PRODUCTION AND TRANSPORT SYSTEM BELOW THE SOUTH POLAR TERRAIN WAS DISCOVERED
DOI:10.1038/s41550-017-0063

2022 ANALYSIS OF ENCELADUS' HEAT FLOW SHOWS ENDOGENOUS ORIGIN OF HEAT
DOI:10.5194/epsc2022-219

2023 NASA WEBB TELESCOPE TEAM OBSERVED A NEW LARGE PLUME SPANNING MORE THAN 6,000 MILES
nasa.gov/solar-system/webb-maps-surprisingly-large-plume-jetting-from-saturns-moon-enceladus



NEPTUNE

2015 A NEW DARK VORTEX DISCOVERED, OBSERVED TILL 2017
DOI:10.3847/1538-3881/aaa6d6

2017 EQUATORIAL STORM FORMED
DOI:10.1016/j.icarus.2018.11.018

2018 FORMATION OF A NEW GREAT DARK SPOT
DOI:10.1029/2019GL081961

2018-2020 ANOMALOUS TEMPERATURE SPIKE, DRAMATIC WARMING OF THE SOUTH POLE
DOI:10.3847/PSJ/ac5aa4

PLUTO

2002 ATMOSPHERIC PRESSURE DOUBLED SINCE 1988
DOI:10.1038/nature01762

2015 CO AND HCN DETECTED IN THE ATMOSPHERE
DOI:10.1016/j.icarus.2016.10.013

2015 ATMOSPHERIC PRESSURE REACHED ITS PEAK, THEN SLIGHTLY DECREASED, AND BY 2020, IT WAS NEARLY EQUIVALENT TO THE LEVELS OBSERVED IN 2015
DOI:10.1051/0004-6361/202141718

2015 NUMEROUS CRYOVOLCANIC FEATURES HAVE BEEN FOUND ON THE SURFACE
DOI:10.1038/s41467-022-29056-3

2019 SUBSURFACE OCEAN DISCOVERED
DOI:10.1038/s41561-019-0369-8

THE SUN

AUGUST 4, 1972
A MAJOR SOLAR FLARE INTERRUPTED LONG-DISTANCE COMMUNICATION IN SOME U.S. STATES
DOI:10.1029/2018SW002024

MARCH 13, 1989
THE LARGEST MAGNETIC STORM OF THE 20TH CENTURY. AURORAS COULD BE SEEN AS FAR SOUTH AS CUBA AND FLORIDA
DOI:10.1029/2019SW002278

JULY 14, 2000
SOLAR FLARE. SATELLITES IN ORBIT HAD SHORT CIRCUITS, SOME RADIO STATIONS WERE SHUT DOWN
DOI:10.1029/2002GL014729

OCTOBER 28-31, 2003
GEOMAGNETIC SUPERSTORM. DISRUPTED SATELLITE SYSTEMS, KNOCKED DOWN A PART OF THE HIGH-VOLTAGE POWER TRANSMISSION SYSTEM IN SOUTHERN SWEDEN
DOI:10.1029/2004SW000123

SEPTEMBER 2005
A POWERFUL GEOMAGNETIC STORM THAT AFFECTED THE TEMPERATURE AND COMPOSITION OF THE MESOSPHERE AND THERMOSPHERE
DOI:10.1029/2018JA025294

DECEMBER 5, 2006
SOLAR FLARE ABOUT 10 TIMES LARGER THAN ANY PREVIOUSLY REPORTED EVENT. OCCURRED NEAR SOLAR MINIMUM. THE GPS SYSTEM WAS SIGNIFICANTLY AFFECTED
DOI:10.1029/2007SW000375

JULY 23, 2012
TWO LARGE CORONAL MASS EJECTIONS TOWARD EARTH'S ORBIT. THE POWER OF THE STORM EXCEEDED ESTIMATES FOR THE CARRINGTON STORM OF 1859
DOI:10.1002/swe.20097

JUNE 21, 2015
GEOMAGNETIC STORM SHUT DOWN RADIO SIGNALS IN THE NORTH AND SOUTH AMERICAS
DOI:10.1007/s11207-018-1303-8

SEPTEMBER 6, 2017
THE MOST POWERFUL FLARE OF SOLAR CYCLE 24 RECORDED
DOI:10.1029/2018SW001969

DECEMBER 2019
CYCLE 24 HAS ENDED, CYCLE 25 HAS BEGUN
weather.gov/news/201509-solar-cycle

2022
SPACEX STARLINK LOST 38 SATELLITES DURING THEIR LAUNCHING TO THE ORBIT DUE TO GEOMAGNETIC STORM FROM CORONAL MASS EJECTION ON JAN. 29
DOI:10.1029/2022SW003193

2023
IT WAS FOUND THAT SOLAR STORMS CAUSE ADDITIONAL FLIGHT DELAYS, WHICH WILL ONLY INCREASE IN THE COMING YEARS
DOI:10.1038/s41598-023-30424-2

JUNE 22, 2023
DAILY SUNSPOT NUMBER (240) EXCEEDED THE MAXIMUM OF CYCLE 24 (220)
sidc.be/silso/dayssnplot

Assumptions that such phenomena in our solar system are caused by solar activity are not supported by facts. Abnormal changes on the solar system planets and their satellites began during the solar minimum period in 1995, that is, when the solar activity was at its minimum. A diagram of solar activity cycles in Figure 67 shows that in 1995 the Sun was at its minimum activity, so it could not have caused all these changes.

Therefore, the Sun could not have had such an impact on other planets. Moreover, of the entire solar system, the Sun reacted to cosmic influences last, most likely due to its immense mass. Since changes occur synchronously on all planets of the solar system as well as on the Sun, it is logical to assume that there is a certain factor from near or deep space that triggers the emergence of a vast amount of energy within the planets. This energy arises within the planetary systems, concentrating around the core and bypassing other layers of the planets. As a result, according to the hypothesis, planetary cores are heated and displaced. None of the known scientific influences - gravitational, electromagnetic, acoustic, cosmic radiation - evade our measuring instruments while directly impacting the core. Therefore, according to the theory, none of the influences listed above can cause the changes currently observed on all planets in the solar system.

Based on the facts outlined above, a hypothesis has been developed suggesting that this influence operates on unexplored physical principles. Modern science is encountering such a phenomenon for the first time. It is a phenomenon that is not officially registered, but its manifestations can be observed. This energy is hypothesized to revive even the dead planets where seismic and magmatic activity is starting to grow. This is confirmed by Mars where seismic[57] and magmatic[58] activity has started to increase.

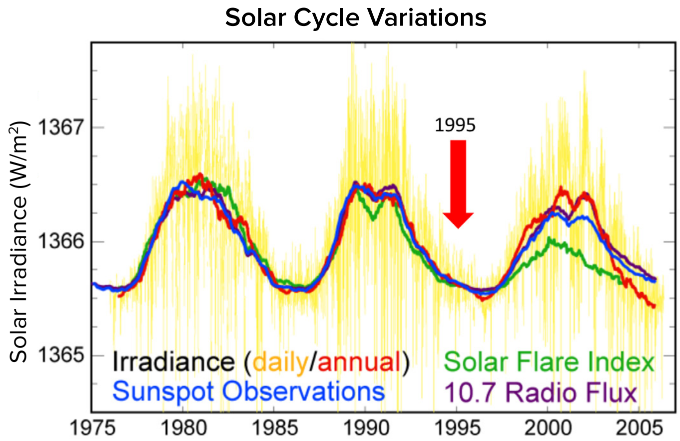


Figure 67

Solar Activity Variations over the Last 30 Years
This figure shows three solar cycles between 1975-2005, measured by solar radiation, the number of sunspots, solar flare activity, and a 10.7 cm radio flux. The graph clearly indicates that in 1995 the Sun was at its minimum activity, hence it could not be the cause of changes in the Earth's core and the cores of other planets in 1995.
Source: Image created by Robert A. Rohde based on published data.
Data source: https://www.pmodwrc.ch/en/research-development/solar-physics/tsi-composite/

[57]Dahmen, N., Clinton, J. F., Meier, M., Stähler, S., Ceylan, S., Kim, D., Stott, A. E., & Giardini, D. (2022). MarsQuakeNet: A more complete marsquake catalog obtained by deep learning techniques. Journal of Geophysical Research: Planets, 127(11). https://doi.org/10.1029/2022je007503
Sun, W., & Tkalčić, H. (2022). Repetitive marsquakes in Martian upper mantle. Nature Communications, 13, 1695. https://doi.org/10.1038/s41467-022-29329-x
Fernando, B., Daubar, I. J., Charalambous, C., Grindrod, P. M., Stott, A., Abdullah Al Ateqi, Atri, D., Ceylan, S., Clinton, J., Fillingim, M. O., Hauber, E., Hill, J. R., Kawamura, T., Li, J., Lucas, A., Lorenz, R. D., Ojha, L., Perrin, C., S. Piqueux, & Stähler, S. C. ... Banerdt, W. B. (2023). A tectonic origin for the largest marsquake observed by InSight. Geophysical Research Letters, 50(20). https://doi.org/10.1029/2023gl103619
[58]Broquet, A., & Andrews-Hanna, J. C. (2022). Geophysical evidence for an active mantle plume underneath Elysium Planitia on Mars. Nature Astronomy, 7, 160–169. https://doi.org/10.1038/s41550-022-01836-3

Astronomical Processes and Their Cyclicity

According to the hypothesis, this influence, which consists of a certain type of energy, interacts directly and solely with the Earth's inner core, without affecting any other shells of the planet. This type of interaction may be attributed to the fact that the inner core has an extremely high density, and its structure likely differs from the generally accepted iron-nickel theory. According to the hypothesis by Dr. I.M. Belozerov, Doctor of Physical and Mathematical Sciences, the inner core has a completely different structure, close to the structure of a neutron star[59]. Whereas, the outer core most likely consists of nickel, iron, and other metal alloys. According to the assumptions, the cores of other planets of the solar system, even the gas giants, have a similar structure.

The hypothesis proposed in this report considers the nature of this influence on Earth in an associative example of a flashlight beam in the darkness. Let's imagine a concentrated beam of light surrounded by scattered illumination. Based on a comprehensive analysis of all the data, only the scattered part of the light is currently reaching Earth. According to observations of ongoing processes, the concentrated beam has not yet touched Earth, but there is already a rapid increase in the frequency and intensity of cataclysms on Earth. Furthermore, according to mathematical models, this trend is expected to continue to escalate. It is important to note that Earth is not encountering this type of influence for the first time. The geological history of our planet indicates that the Earth has repeatedly experienced similar phases of global climate change and geodynamics of a similar synchronous character.

Based on geochronological studies of Quaternary sediments and examination of ice cores and traces of large-scale extinctions, including extinctions of human species, it may be concluded that in the past, the Earth faced a drastic increase in large-scale climatic cataclysms approximately every 12,000 years[60]. And every 24,000 years, planetary disasters likely were many times more powerful, as evidenced by examinations of ash layers of volcanic eruptions in ice cores and other geochronological studies.[61] M. Arushanov, V. Bubnenkov, A. Baturin[62], V. Bushuev[63], I. Kopylov[64], N. Petrov[65], Ye. Smotrin[66], Douglas Vogt[67], and many other researchers[68,69,70,71] have come to understand the cyclical nature of global cataclysms on Earth with a period of approximately 12-13 thousand years, and now, according to the comprehensive analysis of the data, humankind is entering the active phase of this cycle.

---

[59] Belozerov, I. M. (2008). Nature as viewed by a physicist. International Scientific Journal for Alternative Energy and Ecology, 12(68). https://cyberleninka.ru/article/n/priroda-glazami-fizika/viewer
Hruzdov, V. I. (October 2021). Nejtronnaja Vselennaja, Gl. 10. Raschjot nejtronnogo jadra Zemli [Neutron Universe. Ch. 10. Calculation of the Earth's neutron core]. Moscow: Libmonster Russia. Retrieved from: https://libmonster.ru/m/articles/download/17227/4846

[60] Arushanov, M. L. (2023). Causes of Earth climate change, as a result of space impact, dispelling the myth about anthropogenic global warming. Deutsche Internationale Zeitschrift Für Zeitgenössische Wissenschaft, 53, 4–14. https://doi.org/10.5281/zenodo.7795979
Arushanov, M. L. (2023). Dinamika klimata. Kosmicheskie faktory. [Climate Dynamics. Cosmic Factors]. Hamburg: LAMBERT Academic Publishing.

[61] Sawyer, D. E., Urgeles, R., & Lo Iacono, C. (2023). 50,000 yr of recurrent volcaniclastic megabed deposition in the Marsili Basin, Tyrrhenian Sea. Geology, 51(11), 1001–1006. https://doi.org/10.1130/g51198.1

[62] Baturin, A. M. (2001). Periodichnost globalnykh katastrof - 12166 let. [Periodicity of Global Catastrophes - 12166 years"] Monograph. Kursk CSTI.

[63] Bushuev, E. V., & Kopylov, I. P. (2005). Kosmos i Zemlja. Elektromekhanicheskie vzaimodejstvija. [Space and Earth. Electromechanical Interactions]. Monograph. Moscow: Energy.

[64] Kopylov, I. (2001, November 1) Elektromekhanika Solnechnoj sistemy [Electromechanics of the solar system]. NVO.

[65] Petrov, N. V. (2015). The Climate of the Earth: The solution to the problem of climate change of the Earth from the position of the law the preservation of life in space. Ecology and Society Development: Journal of the International Academy of Ecology, Human and Nature Safety Sciences, 4, 11-23. http://www.trinitas.ru/rus/doc/0016/001d/2551-ptr.pdf

In geology, paleontology and archaeology, there is a number of evidence of previous disasters of the cycle. Each of those catastrophic events was characterized by not only abrupt changes in the Earth's climate, but also complete geodynamic restructuring: weakening and excursion of the magnetic field, disastrous widespread volcanic eruptions, tectonic rearrangements, atmospheric temperature fluctuations by 10 °C[72], changes in the level of the world ocean, and subsequent large-scale glaciations (Figures 68-72).

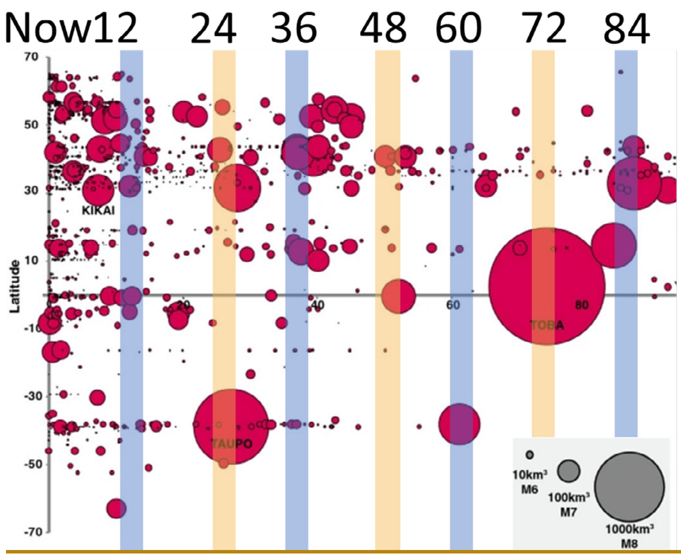


Figure 68

Global-scale eruptions from 2013 AD to 100,000 cal. between latitude 70° north and latitude 70° south. In the picture you can see when such eruptions occurred. Circle sizes reflect the scale of eruptions. Note that the large red circles indicate that every 24,000 years volcanic eruptions are more disastrous.

Source: Brown, S. K., Crosweller, H. S., Sparks, R. S. J., Cottrell, E., Deligne, N. I., Guerrero, N. O., Hobbs, L., Kiyosugi, K., Loughlin, S. C., Siebert, L., & Takarada, S. (2014). Characterisation of the Quaternary eruption record: analysis of the Large Magnitude Explosive Volcanic Eruptions (LaMEVE) database. Journal of Applied Volcanology, 3(5). https://doi.org/10.1186/2191-5040-3-5

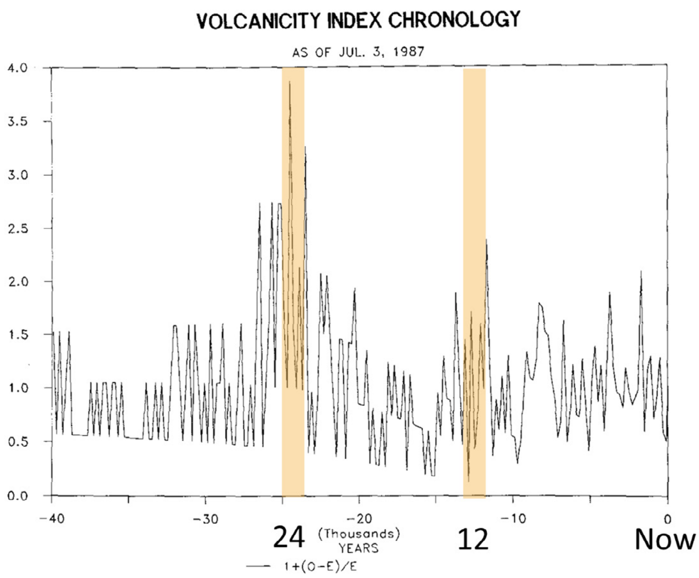


Figure 69

Scale of volcanic activity over the last 40 thousand years according to ice core data. Chronology of the number of volcanic eruptions based on radiocarbon dating of events and expressed as a relative deviation.

Source: Bryson, R. A. (1989). Late quaternary volcanic modulation of Milankovitch climate forcing. Theoretical and Applied Climatology, 39, 115–125. https://doi.org/10.1007/bf00868307

[66] Smotrin E. G., candidate of military sciences. (1998). Natural disasters and catastrophes — the main threat to planetary and Eurasian security upon entering the 3rd millennium AD. Geostrategy and Technologies XXI. Retrieved from: http://www.geost-21.su/ru/node/1

[67] Vogt, D. B. (2007). God's Day of Judgment; The real cause of global warming (1st Ed.). Vector Associates. ISBN-13:978-0-930808-08-2
Vogt, D. B. (2015). The theory of multidimensional reality. Vector Associates. ISBN-13: 978-0-930808-10-5.

[68] Davidson, B. (2021). The next end of the world. Space Weather News. ISBN 9781098357788

[69] Thomas, C. (1993). The Adam & Eve story: The history of cataclysms. Bengal Tiger Pr, ISBN 9781884600012

[70] White, K. W. (1992). World in peril: The origin, mission, and scientific findings of the 46th/72nd Reconnaissance Squadron, K. White, ISBN 0962891681.

[71] Hapgood, C. H. (1958). Earth's shifting crust: A key to some basic problems of earth science. Pantheon Books, - Science.

[72] Easterbrook, D. J. (2016). Evidence-based climate science, data opposing CO2 emissions as the primary source of global warming, (2nd Ed.) Elsevier. Bellingham, USA. https://doi.org/10.1016/C2015-0-02097-4

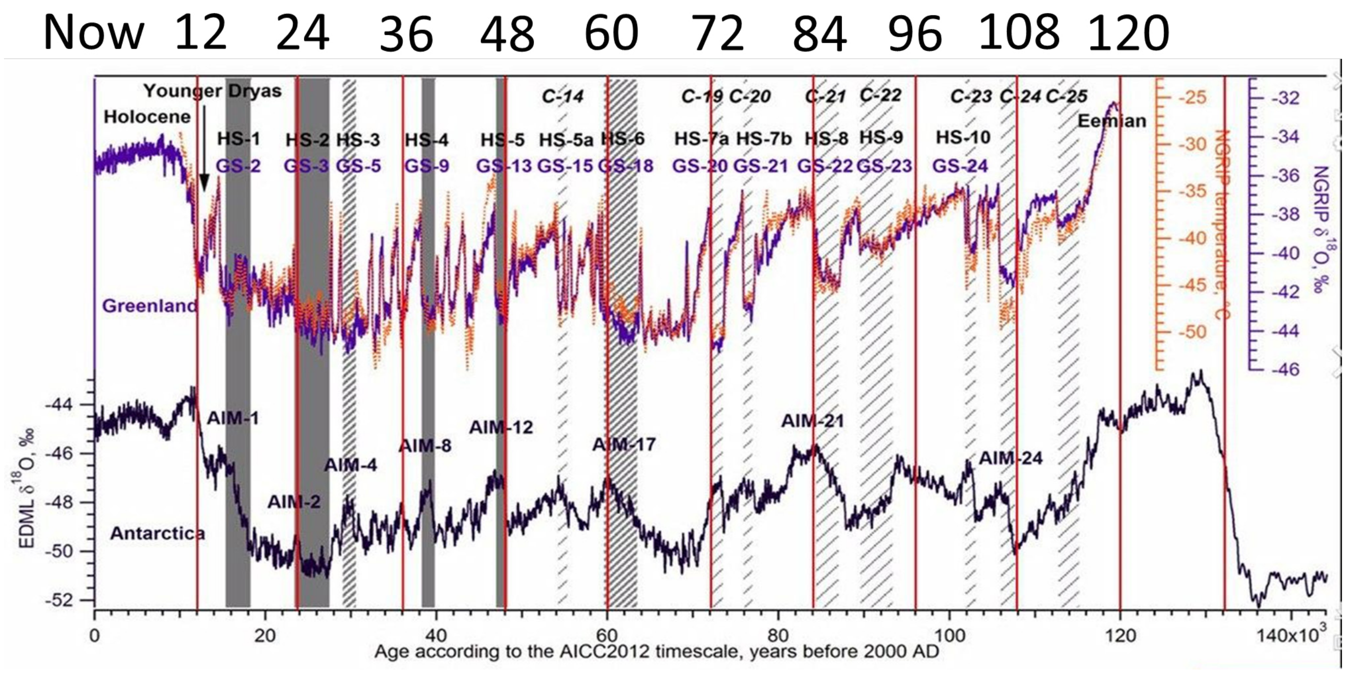


Figure 70

Temperature anomalies from Greenland and Antarctic ice core data.
Source: Heinrich, H. (1988). Origin and consequences of cyclic ice rafting in the Northeast Atlantic Ocean during the past 130,000 years. Quaternary Research, 29(2), 142–152. https://doi.org/10.1016/0033-5894(88)90057-9

Event	Age in thousands of years before present		
	Hemming (2004)	Bond & Lotti (1995)	Vidal *et al.*. (1999)
H0	~12		
H1	16.8		14
H2	24	23	22
H3	~31	29	
H4	38	37	35
H5	45		45
H6	~60		

H1 and H2 are identified using radiocarbon dating, H3-6 are correlated with GISP2.

Figure 71

Approximate relative position of Heinrich events initially recorded in marine sediment cores from the North Atlantic Ocean.
Source: Heinrich, H. (1988). Origin and consequences of cyclic ice rafting in the Northeast Atlantic Ocean during the past 130,000 years. Quaternary Research, 29(2), 142–152. https://doi.org/10.1016/0033-5894(88)90057-9

Time (Years Ago)	Magnetic Event	Volcanic Candidates	Biosphere Stresses
~12,000	Gothenburg	Eifel Complex (German), Phlegraean Fields (Italy)	Mega-Faunal Extinction, Global
~25,000	Lake Mungo	Aira Caldera (Japan), Taupo (New Zealand)	Mega-Faunal Extinction, Australia/Eurasia. W.Africa Human Abandonment
~36,000	Mono Lake	Campi Flegrei (Italy), Gorley (Russia)	Mega-Faunal Extinction, North America
~47,000	Laschamp	Kulie Lake (Russia), Lake Shitkotsu (Japan)	Mega-Faunal Extinction, Global. Neanderthal Extinction
~60,000	Vostok	(None VEI 7 or Greater)	(No Major Discoveries)
~72,000	Toba	Toba (Indonesia), Santorini (Greece)	Largest Human Bottleneck, <5000 Humans Survived
~84,000	(unnamed)	Atitlan (Guatemala)	(No Major Discoveries)
~96,000	(unnamed)	Mount Aso (Japan)	(No Major Discoveries)
~105,000	Blake?	(None VEI 7 or Greater)	Mega-Faunal Extinction?
~120,000	Blake?	Mount Aso (Japan)	Mega-Faunal Extinction?

Figure 72

Magnetic pole drift, magnetic field weakening, catastrophic eruptions and extinctions every 12,000 years

This hypothesis suggests that geodynamic changes on Earth are primarily derivatives of astronomical processes and their cyclicity. As in previous cycles, a significant factor in the increase of catastrophes today is the accumulation of additional energy in the Earth's interior from external cosmic influences. However, this cycle is exacerbated by anthropogenic impacts on the Earth system, which increases the amount of heat within the planet's depths. As a result of entropy — the conversion of additional energy into heat — the Earth's mantle becomes hotter, magma becomes more fluid, the flow of endogenous heat from the interior to the surface increases, and new magma plumes are formed. Today, for example, such massive plumes are rising very rapidly under Siberia, partly due to the shift of the core in this direction.

Abnormal Heating of Siberia

Siberia and the Siberian Arctic are regions where heating rates are 2-3 times higher than the global average (Fig. 73). According to the hypothesis, this is linked to the formation of magma plumes due to a shift in the Earth's core, which causes stress on the mantle in this region (Figs. 74–76). This is supported by recent studies by Chinese scientists, who have found that the crust under Siberia is now melting and thinning due to magma activity[73]. This process is progressive and reduces the strength of the plate. It is likely that the activity of magma plumes may also manifest in additional thawing of permafrost from the bottom up, increasing seismic activity in the region, the rise of hot waters to the surface, and fires under the snow above fault zones. In northern latitudes, there is an increase in methane and hydrogen emissions from the depths, a growing number of craters from natural gas explosions, and intensified mud volcanism on the Arctic shelf. According to tectonophysical models, a magma breakthrough under Siberia will force molten matter to the surface under high pressure. This could pose a direct threat to the existence of Russia and the entire world.

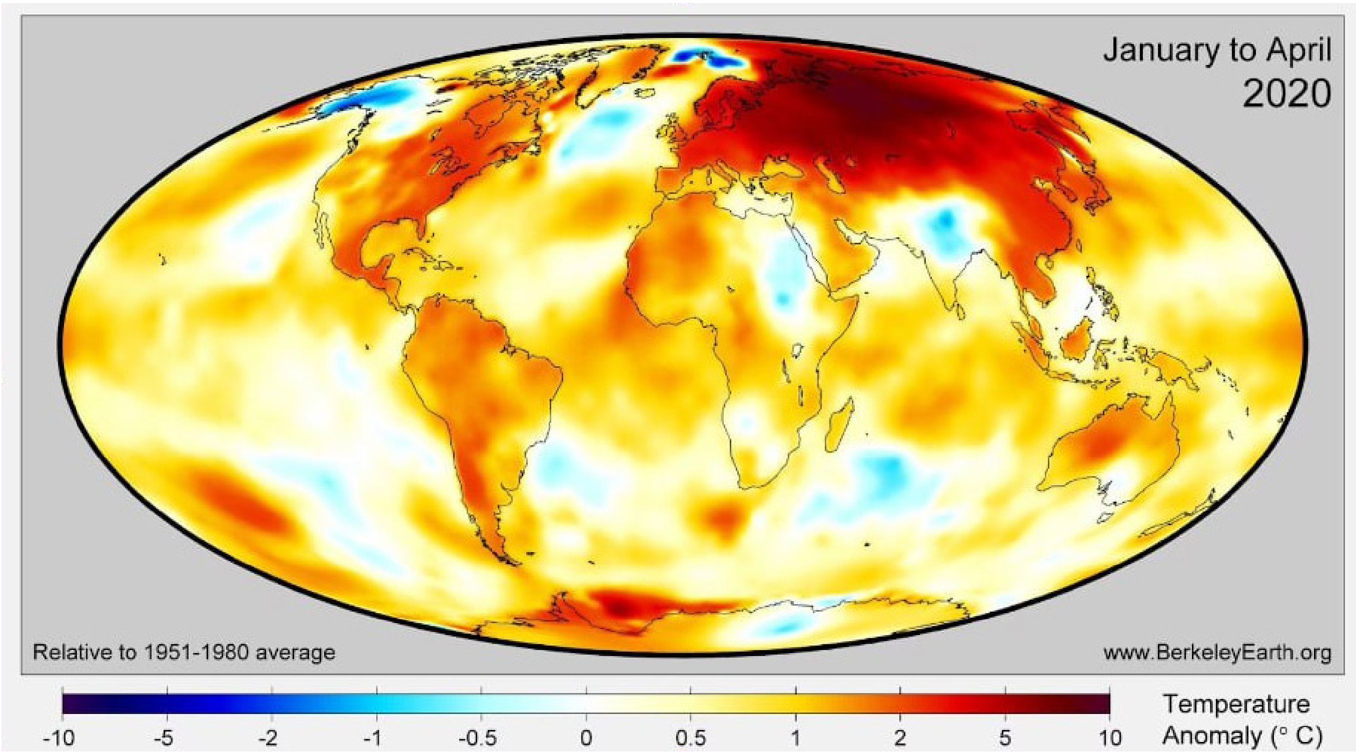


Figure 73

Temperature anomalies in the world for the period January-April 2020 relative to the 1951-1980 norm. The warming in the Siberian region exceeds the global temperature anomaly by a factor of 3-6, indicating an additional factor causing heating of this region. Source: BerkeleyEarth.org

[73] Li, S., Li, Y., Zhang, Y., Zhou, Z., Guo, J., & Weng, A. (2023). Remnant of the late Permian superplume that generated the Siberian Traps inferred from geomagnetic data. Nature Communications, 14, 1311. https://doi.org/10.1038/s41467-023-37053-3

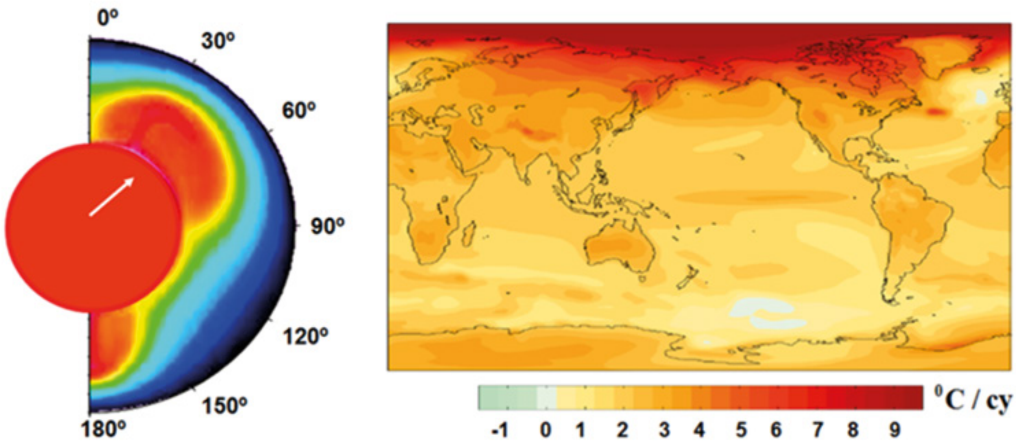


Figure 74

Forced relative shift of the core and mantle, and the scheme of asymmetric heat supply to the upper layers of the mantle (on the left). Linear trends of surface warming (in °C per century) according to NCAR CCSM3 data averaged according to a special scenario http://www.realclimate.org/bitz_fig3.png) (on the right).

Source: Barkin, Yu.V. (2009). Ciklicheskie inversionnye izmenenija klimata v severnom i juzhnom polusharijah Zemli [Cyclic Inversion Climate Change in the Northern and Southern Hemispheres of Earth]. Geology of the Seas and Oceans: Materials of the XVIII International Scientific Conference (School) on Marine Geology. Vol. III. - Moscow: GEOS. pp. 4-8.

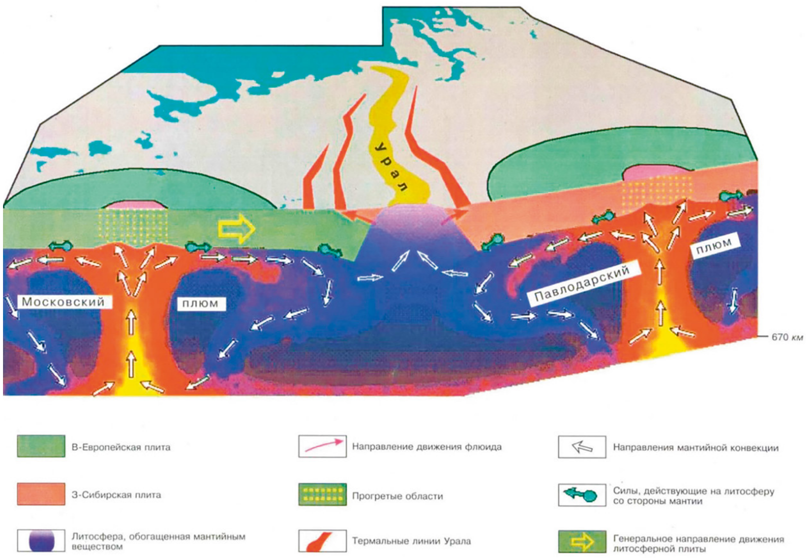


Figure 75

Scheme of the movement of hydrocarbon fluids in Moscow and Pavlodar plume-tectonic structures.

Source: Gorny, V. I. et al. (2001) Model of the Mantle-Lithospheric Interaction Based on Data from Uralseys Geotraverse for Prospecting Seismology and Remote Geothermal Method. Deep Structure and Geodynamics of the Southern Urals. Tver. pp. 227-238.

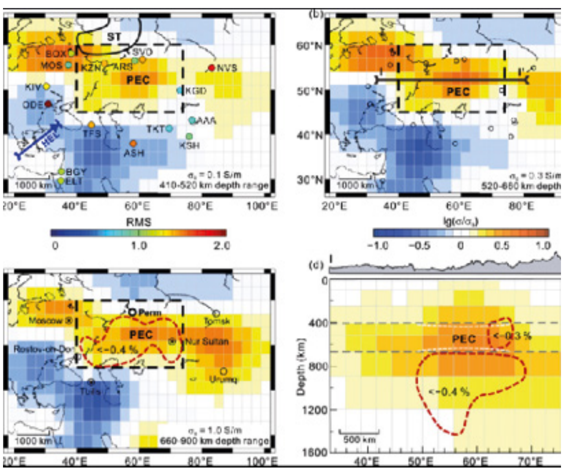


Figure 76

Scientists from Jilin University and Shijiazhuang Tiedao University used geomagnetic field data from 16 stations in Northern Asia to calculate the electrical conductivity of the mantle at various depths. They discovered a noticeable increase in conductivity relative to the worldwide average conductivity in the region under the Siberian Traps (yellow and brown areas on the diagrams). Researchers have ascertained that these areas at depths from 400 to 900 km are on average 250 degrees hotter than the surrounding mantle. In these areas, there is a fraction of the molten mantle.

Source: Li, S., Li, Y., Zhang, Y., Zhou, Z., Guo, J., & Weng, A. (2023). Remnant of the late Permian superplume that generated the Siberian Traps inferred from geomagnetic data. Nature Communications, 14, 1311. https://doi.org/10.1038/s41467-023-37053-3

For comparison, an activation of the Yellowstone supervolcano in the USA, which also shows signs of abnormal activity, can cause a destruction of the entire American continent, but there would still be a chance for humankind to survive. However, in the event of a magma breakthrough through the lithospheric plate under Siberia, it can be asserted that this would make life impossible for all living things on the planet Earth.

The Current Cycle of Planet Earth

By the end of 2024, an increase in volcanic activity is possible, caused by the rise of magma and the erosion of lithospheric plates by magmatic flows. That could lead to frequent earthquakes and volcanic eruptions. This conclusion is based on the following observations: geophysical and geodynamic parameters of the Earth underwent sharp changes in 1995 and 1998, which triggered an exponential trend in the increase of seismic activity and destabilization of the planet's interior. This indicates a buildup of energy and tension within the Earth's depths and an exponentially increasing release of energy. The ocean and atmosphere react with a delay to the processes in the depths, but an exponential trend is already evident in the graphs of their changes.

Based on the current exponential progression of increasing earthquakes worldwide, an analysis of the exponential trend in the graph was conducted, and on this basis, a model was constructed to predict the growth in the number of earthquakes in the coming years (Fig. 77).

The modeling results are as follows: by 2028, there will be 1,000 earthquakes per day with a magnitude of 3.0 and higher on Earth, whereas currently, there are about 125 occurring daily. Based on model calculations, by 2030, the number of earthquakes will likely increase to such an extent that adaptation to the changed conditions will become impossible.

It is expected that an increase in the number of small-magnitude seismic events, which indicate rising magmatic activity and a widespread increase in volcanic activity, will most likely lead to an increase in the number of strong earthquakes. There is a high probability that within six years, earthquakes equivalent in destructiveness to the earthquake in Turkey and Syria on February 6, 2023, will occur daily.

As a result of the anticipated changes, many cities and states may face severe destruction. Applying the exponential function to assess the damage from climate disasters shows that the global economy may struggle to compensate for the losses within the next 4-6 years, potentially leading to an economic crisis. Forecasts indicate a possible collapse of global business during this period. Mathematical modeling suggests that within the next 10 years, the conditions for life on Earth could change significantly.

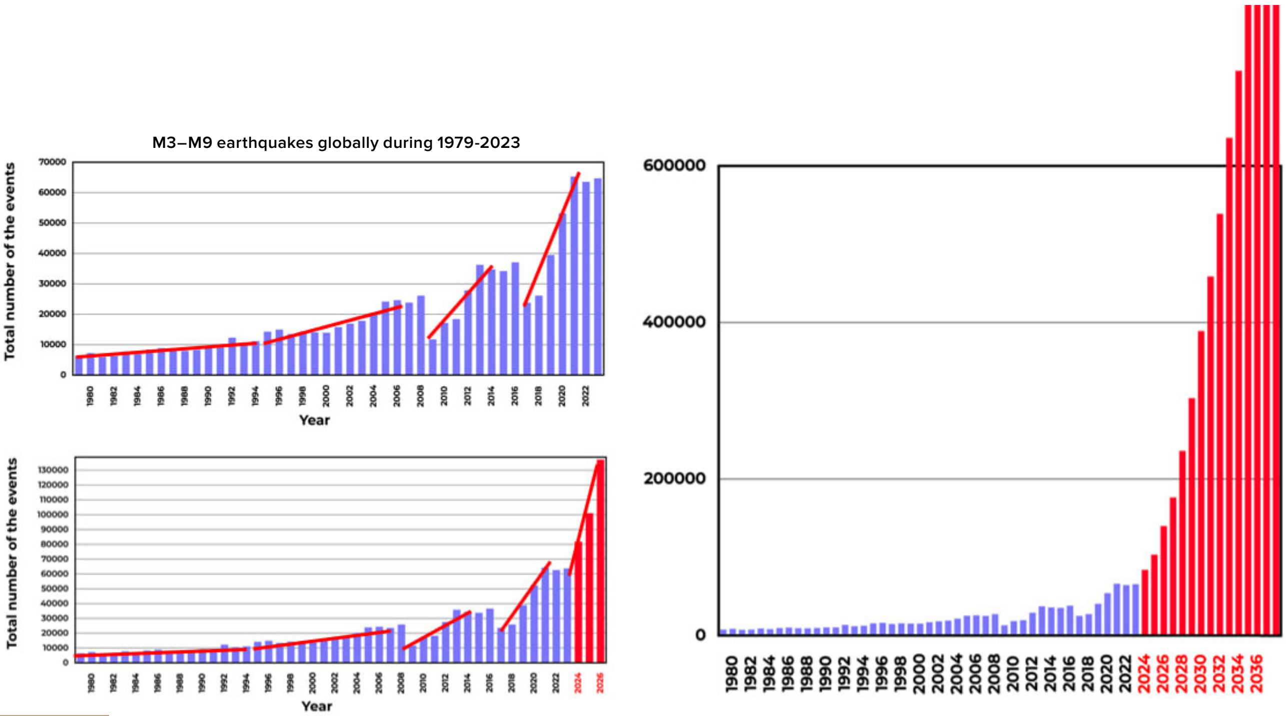


Figure 77

Model of the exponential growth in the number of natural cataclysms on the example of earthquakes up to 2036.

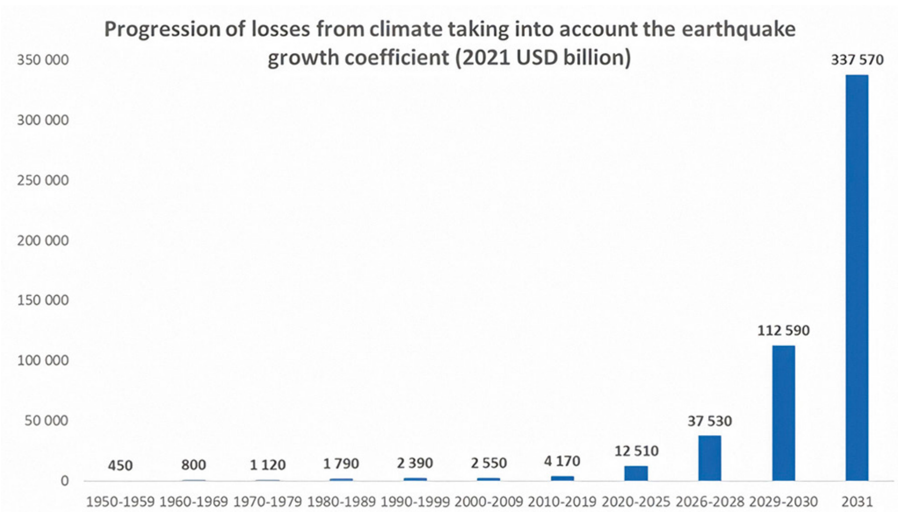


Figure 78

Forecasted economic losses from natural disasters, according to the model of exponential growth in the number of geodynamic and climate catastrophes (2021 USD billion).
Data Source: AON (Catastrophe Insight).

Based on this trend, an increase in the number of all other natural disasters worldwide in the near future can be predicted. Scientific facts confirm the inevitable progression of climate disasters, and as of today, nothing is holding back the escalation of cataclysms around the world. Solar flares can already cause disruptions in satellite operations today, underscoring the importance of preparing for potential technological problems. Forecasts suggest that significant changes could occur within the next 4-6 years, affecting the viability of many regions. According to the described model's further progression, critical events that could impact the planet's integrity may occur.

In previous cycles of catastrophes occurring every 12,000 years, there were extinctions of species, but the planet passed through these cycles without significant changes in the integrity of its systems. In the current cycle, characterized by more severe disasters due to a 24,000-year cycle, another factor has been added that threatens the planet's existence as a habitable entity. This anthropogenic factor previously mentioned in the report plays a crucial role in significantly worsening the planet's situation. This anthropogenic impact is manifested in the pollution of the planet's primary cooling mechanism—the contamination of the world's ocean waters with microplastics.

The ocean plays a crucial role in the planet's thermoregulation. It covers about 70% of the Earth's surface and extends deep into the Earth's crust. In the past, the ocean served as a mechanism for dissipating excess heat from the planet's interior into the atmosphere and subsequently into outer space. Humankind has significantly reduced the ocean's heat-conducting function due to dumping of hydrocarbon products and synthetic polymers into it. This results in the ocean's inability to dissipate heat from the lithospheric plates, which are warmed by rise of magma during the 12,000-year cycle of catastrophes (Figure 79). The world ocean has never been so heavily polluted before. As a result of oil extraction, transportation and related accidents, up to 30 million tons of hydrocarbons enter the ocean annually[74]. The overall area of "plastic islands" of garbage on the ocean's surface is nearly equivalent to the combined land area of the United States and Australia. However, this constitutes only 1% of total pollution, as 99% of plastic is dispersed within the ocean water[75].

In addition to ocean pollution with microplastics, anthropogenic activities, including the burning of hydrocarbons, lead to an increase in the concentration of greenhouse gases such as methane (CH_4) and carbon dioxide (CO_2) in the atmosphere. Glacier and permafrost melting exacerbates this effect, increasing methane concentration in the atmosphere. This is particularly dangerous because methane has a greenhouse effect that is 25 times greater than that of carbon dioxide: one ton of methane produces the same warming effect as 25 tons of carbon dioxide.

Additionally, ocean acidification leads to a faster decomposition of microplastics into nanoplastics, further exacerbating the situation by increasing heat accumulation in the ocean.

The use of hydrocarbons, particularly methane and oil, for fuel combustion and plastic production has significantly worsened the planet's ecological situation, leading to the accumulation of excess heat in both the oceans and the atmosphere. The anomalous increase in atmospheric and ocean temperatures indicates an unprecedented reduction in the oceans' ability to absorb heat from the Earth's depths, which is critically necessary during the influx of additional energy to the planet's core during the 12,000-year cycle.

Studying coral reefs in the ocean also enables us to comprehend that in the past, the ocean efficiently dissipated heat. Currently, coral reefs are perishing[76] due to overheating, despite the fact that they have existed for thousands of years and survived the previous 12,000-year cycles of natural disasters.

---

[74] Alexeev, G. V., Borovkov, M. I., & Titova, N. E. (2018). Sovremennye sredstva dlja ochistki vody ot maslo-zhirovyh jemul'sij i nefteproduktov. [Modern means of purifying water from oil-fat emulsions and petroleum products]. Colloquium-journal, 7(18), 4-6.

[75] Lebreton, L., Egger, M., & Slat, B. (2019). A global mass budget for positively buoyant macroplastic debris in the ocean. Scientific Reports, 9, 12922. https://doi.org/10.1038/s41598-019-49413-5

[76] Hughes, T. P., Kerry, J. T., Baird, A. H., Connolly, S. R., Dietzel, A., Eakin, C. M., Heron, S. F., Hoey, A. S., Hoogenboom, M. O., Liu, G., McWilliam, M. J., Pears, R. J., Pratchett, M. S., Skirving, W. J., Stella, J. S., & Torda, G. (2018). Global warming transforms coral reef assemblages. Nature, 556, 492–496. https://doi.org/10.1038/s41586-018-0041-2

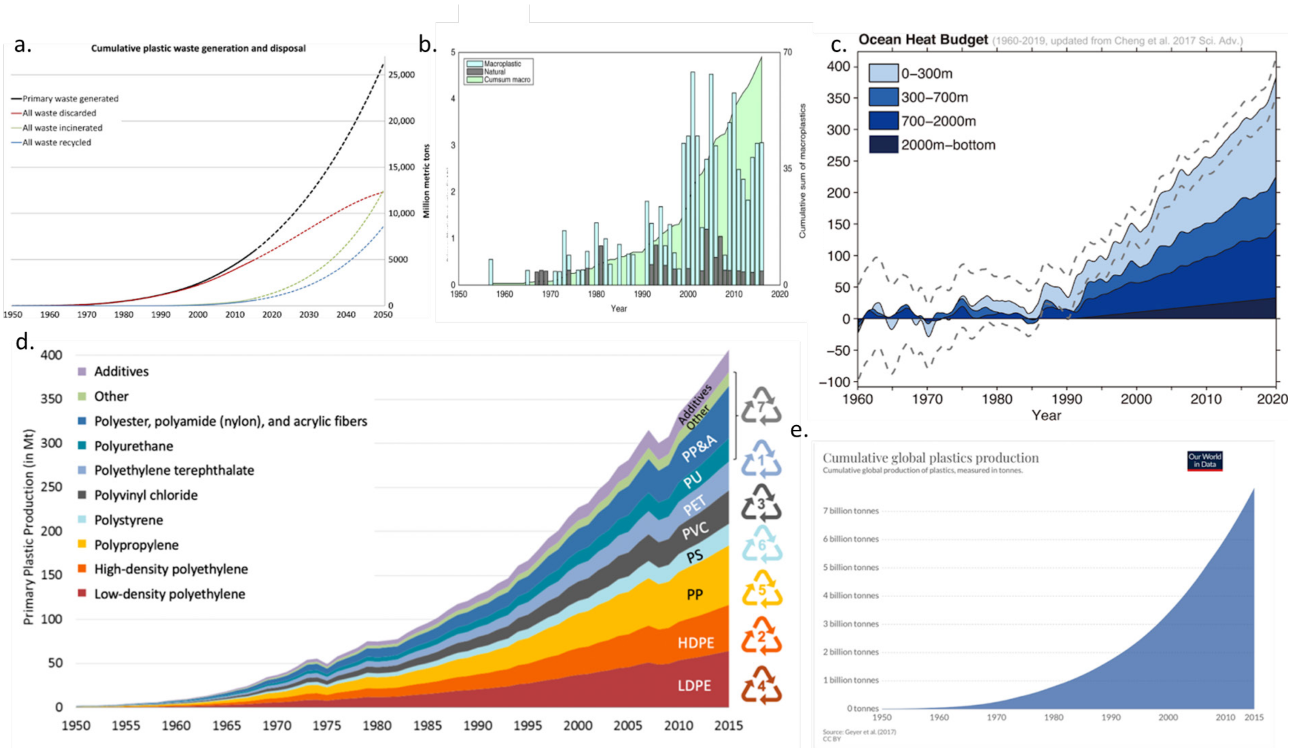


Figure 79

Diagrams of changes in ocean temperature from 1960-2019 and their comparison with the diagrams of growth in the production of synthetic polymers, their use in various sectors of economy, and disposal of plastic waste in the ocean (from various sources).

a. Cumulative plastic waste generation and disposal
Geyer, R., Jambeck, J. R., & Law, K. L. (2017). Production, use, and fate of all plastics ever made. Science Advances, 3(7). https://doi.org/10.1126/sciadv.1700782
b. Cumulative sum of microplastic in the ocean and annual counts
Ostle, C., Thompson, R. C., Broughton, D., Gregory, L., Wootton, M., & Johns, D. G. (2019). The rise in ocean plastics evidenced from a 60-year time series. Nature Communications, 10(1622). https://doi.org/10.1038/s41467-019-09506-1
c. Ocean heat budget from 1960 to 2019 (Purkey and Johnson, 2010; updated from Cheng et al., 2017)
Cheng, L., Abraham, J., Zhu, J., Trenberth, K. E., Fasullo, J., Boyer, T., Locarnini, R., Zhang, B., Yu, F., Wan, L., Chen, X., Song, X., Liu, Y., & Mann, M. E. (2020). Record-Setting Ocean Warmth Continued in 2019. Advances in Atmospheric Sciences, 37, 137–142. https://doi.org/10.1007/s00376-020-9283-7
d. Global primary plastic production by polymer type
Geyer, R., Jambeck, J. R., & Law, K. L. (2017). Production, use, and fate of all plastics ever made. Science Advances, 3(7). https://doi.org/10.1126/sciadv.1700782
e. Cumulative global production of plastics since 1950
Data source: Plastic Marine Pollution Global Dataset

Due to the increased heating of the Earth's interior and the loss of the planet's cooling capability due to anthropogenic factors, there is a threat that this time, Earth will not cope with the cycle of catastrophic events, potentially leading it to a fate similar to that of Mars. Tectonophysical modeling has allowed for the examination of a possible scenario for the further development of events up to the projected point of no return.

The processes described above currently observed within the Earth's interior are driven by anthropogenic factors and the overheating of the planet's core due to the influx of excessive energy from space. The core overheats the magma, leading to the melting of the mantle and the magma exerting pressure on the Earth's crust. As a result of this pressure, the crust fractures, breaks, and forms pathways for the release of deep-seated magma.

Tectonophysical and Mathematical Modeling of the Projected Point of No Return in 2036

There is a specific location on Earth that poses a critical threat to the entire planet. It is the only point on Earth where unique conditions combine: the thinnest crust and high magmatic activity beneath it. Furthermore, at this location, the crust is heavily compressed by both rising magma from below and the layer of ocean water above, approximately 11 kilometers thick. This location, known as the Mariana Trench, is the deepest on Earth, and it currently poses the greatest threat to our planet.

Let's consider the first graph (Figure 80), which illustrates the trend in the increase of deep-focus earthquakes in the Mariana Trench region over the past three decades. There has been a sharp increase in the number of deep-focus earthquakes in the Mariana Trench region since 1995. Deep-focus earthquakes, occurring at depths of 300–800 kilometers in the mantle, can release energy comparable to nuclear explosions of immense destructive power. The Mariana Trench is one of the most geodynamically active regions in the world where such events occur. This indicates active processes taking place in the mantle beneath the Mariana Trench.

The second graph in Figure 81, demonstrates the growth in the number of surface earthquakes in the Mariana Trench. This increase can be described by an exponential function. So far, there are no signs of decrease in this trend.

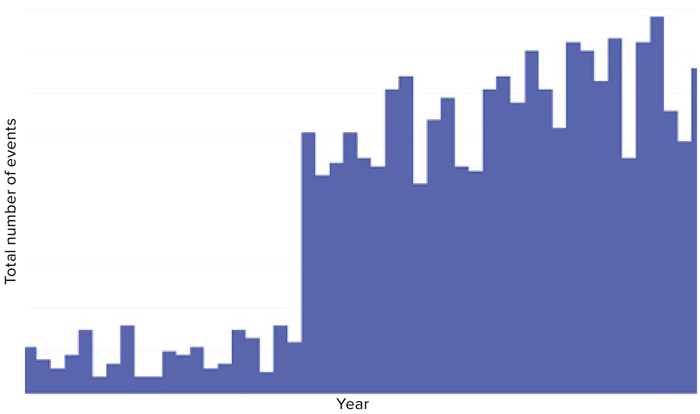


Figure 80

Total number of M1+ deep-focus earthquakes in the Mariana Trench area from 1970 to 2023.
Data Source: International Seismological Centre http://www.isc.ac.uk/iscbulletin

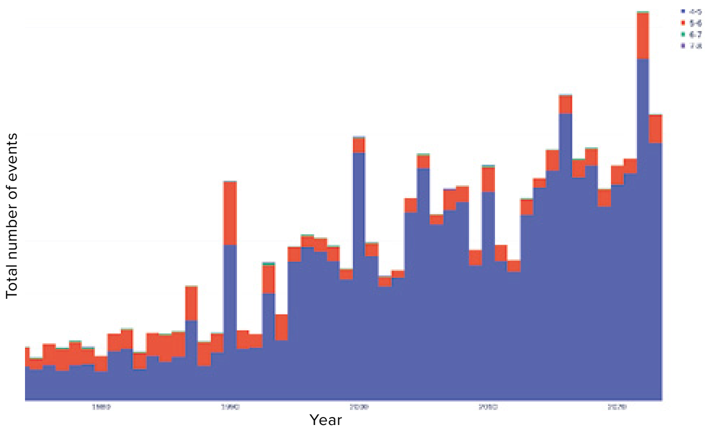


Figure 81

Total number of M4+ shallow earthquakes in the Mariana Trench area from 1970 to 2023.
Data Source: International Seismological Centre http://www.isc.ac.uk/iscbulletin

According to USGS data[77], more than 120 consecutive earthquakes with magnitudes greater than 4.0 were recorded in the Mariana Trench region on November 24-25, 2023. This is the highest number of earthquakes in one day in the area in the entire history of observations. This recent seismic activity suggests that the situation beneath the Mariana Trench is only getting worse.

According to mathematical and tectonophysical model, seismic and magmatic activity will continue to increase exponentially, leading to the following events in 2036.

As a result of intensified geological activity within the Earth's interior, magma could penetrate through the Earth's crust in the area of the Mariana Trench. Under the extreme pressure in this zone, a full-scale rupture could occur. Billions of cubic meters of water at approximately 0°C would meet billions of cubic meters of magma at a temperature of 1,600°C, causing an explosion thousands of times more potent than the arsenal of all nuclear weapons on Earth. This event could raise a massive column of steam mixed with dust to more than 500 km height and breach the thermosphere. According to modeling, the atmosphere, having lost its integrity, could wrap around the planet due to changes in surface tension and could also be easily swept away by the solar wind. It should be noted that the development of such a scenario would result in the loss of the atmosphere, oceans, and magnetic field, and likely, the rotation of the Earth's core would stop, similar to what is believed to have happened on Mars.

The Mariana Trench on Earth, similar to Mariner Valley on Mars, is a region with a relatively thin planetary crust. Around Mariner Valley, extensive flows of volcanic lava are visible, indicating that Mariner Valley was a site of significant geological changes that influenced the degradation of Mars' condition. Similar geological processes are currently observed in the Mariana Trench, which likely occurred in Mariner Valley on Mars. It is suggested that such processes could lead to significant consequences for Earth and its biological life forms. However, if the current exponential trends in the development of changes on Earth continue to progress, humanity may be unable to witness Earth transitioning to a state like Mars, as it risks disappearing sooner due to other causes.

According to updated data, the rate of increase in catastrophes exceeds even the most pessimistic forecasts. This means that humanity has virtually no time left to address the consequences of anthropogenic ocean pollution and the issue of external cosmic influence. The exponential trend in the number and intensity of Earth's climatic and geodynamic disasters places humanity on the brink of extinction within the next 10 years.

Is there any reason to believe that the current climate changes will stop on their own? Scientific data indicate that even cessation of all anthropogenic carbon dioxide emissions now would not halt the ongoing climate changes. The reason humanity is moving towards a projected point of no return is the anthropogenic factor - the ocean's heat dispersal functions have been compromised by its pollution with micro- and nanoplastics, coinciding with the influx of additional cosmic energy to the Earth's interior.

[77] USGS. (n.d.). Search results: Seismic activity in the Mariana Trench region according to USGS data. https://earthquake.usgs.gov/earthquakes/map/?extent=-15.62304,98.08594&extent=45.39845,196.52344&range=search&search=%7B%22name%22:%22Search%20Results%22,%22params%22:%7B%22starttime%22:%222023-11-23%2000:00:00%22,%22endtime%22:%222023-11-26%2023:59:59%22,%22maxlatitude%22:29.075,%22min-latitude%22:6.49,%22maxlongitude%22:155.215,%22minlongitude%22:133.242,%22minmagnitude%22:2.5,%22orderby%22:%22time%22%7D%7D

Consequently, even a complete cessation of industrial activity would not radically improve the climate balance, as the global processes of heating the Earth's interior have already been set in motion. Therefore, one of the solutions to this critical situation is to study the external cosmic influence currently affecting the core of our planet and the cores of other planets in the Solar System.

Mitigating this threat requires the development of effective solutions. Despite the limited scientific knowledge of this influence, we can observe that the cores of planets interact with it. It can therefore be concluded that the external cosmic influence is an unknown physical phenomenon. Since this problem is of physical nature, its solution is also within the realm of physics. To address this issue, it is necessary to bring together leading scientists from around the world so that they can concentrate all their efforts on studying this physical problem.

In order to achieve this goal, it is crucial to bring awareness about this problem to the global community. The only way we will have a chance for life, for our future and the future of our children, is when there emerges a universal demand, urging those in power to create conditions for uniting the world's scientists in the search for solutions to climate problems.

Part 3

SOLUTION IS POSSIBLE

Perhaps, a question arises why there is no public dissemination of the information about the real scale of the climate threat and no high-level discussion of it among scientists and politicians. The answer lies in the peculiarities of the work of human subconsciousness. The subconscious is structured in such a way that if it doesn't see a way out of a critical situation, it simply blocks reality and denies the existence of a threat.

For this very reason, many of those people who have familiarized themselves with the above facts and received exhaustive proof of an impending planetary disaster do not react to the situation appropriately. They do not believe that humankind will be able to cope with this challenge and survive. The key goal of this report is to provide evidence that a solution to the problem of climate collapse exists.

OCEAN RESTORATION

Crucial requirement for the survival of humanity is the restoration of the ocean's function to dissipate heat from the Earth's interior. Otherwise, as previously mentioned, the planet Earth may reach a projected point of no return during this cycle. Let's delve deeper into the processes that play the most significant role in manifesting the catastrophic danger of magma breakthrough in the area of the Mariana Trench.

During the 12,000-year cycle, external cosmic influence causes the planet's core to overheat the mantle. In this cycle, excessive heat does not escape from the mantle due to a failure in the ocean's cooling function, attributed to anthropogenic factors. This contributes to an abnormal increase in magma temperature and intensive melting of the mantle.

The magma, located in close proximity to the core, becomes extremely hot and fluid, actively eroding the mantle and forming new pathways to the Earth's surface. According to the model, this leads to the formation of channels and magmatic rivers in the mantle. Evidence suggests that this process is already observable in Siberia.

According to the hypothesis, when magmatic rivers collide, intramantle explosions occur, caused by nuclear reactions that release large amounts of energy. These explosions destabilize the Earth's core and further increase the temperature inside the planet and seismic activity within the crust.

Mathematical calculations indicate that the rate of mantle melting on Earth is accelerating. By the end of 2024, when external cosmic influence on the core intensifies, the heating and melting of magma will significantly increase. It is anticipated that the magma will rise increasingly closer to the surface over time.

Tectonophysical modeling shows that when the entire mantle melts, deep-focus earthquakes will cease, and the Earth's crust may be easily breached by magma in the area of the Mariana Trench.

That is why restoring the ocean's function is a vital condition for the survival of humankind and the planet.

An additional consequence of the ocean's heat dissipation function being disrupted by anthropogenic factors is excess atmospheric moisture.

Since the temperature of the world's oceanic waters increases, moisture evaporates intensively. When water evaporates, it also takes thermal energy from the ocean into the atmosphere. As moist air rises and reaches the colder layers of the atmosphere, the water vapor condenses, which means it turns back into liquid water. This leads to cloud formation and eventually to abnormal rainfalls, spring floods and inundations.

A paradox arises: there is more water vapor in the atmosphere, and extreme floods are on the rise around the world, but at the same time half of the globe is suffering from droughts. This occurs due to the increase in atmospheric temperature. The higher the temperature of the air is, the more moisture it can hold. As moisture evaporates, it stays in the atmosphere for a long time without returning to the earth in the form of precipitation. This leads to long periods of drought in certain regions of the world.

Warm and humid atmosphere also favors the formation of tropical cyclones and increases their destructive power. Warm and moist air, because of its lower density, rises to form low-pressure zones, which increases wind speeds. When water in the atmosphere condenses, it releases all the accumulated thermal energy that was absorbed during evaporation.

This thermal energy is the main source of energy for tropical cyclones. When wind, water, and thermal energy combine, they gain destructive power.

Restoring the ocean's functions, including its ability to remove heat from the Earth's interior and maintain environmental stability, can be achieved through the widespread use of devices that extract water from the air, namely, atmospheric water generators (AWGs). They will not only provide enough water for the entire world's population, but will also help clean the world's oceans of micro- and nanoplastics. As previously discussed in Part 2 of this report, plastics and microplastics, because of their unique chemical composition, disrupt the ocean's thermal conductivity, thereby preventing the dissipation of heat from the interior. With the mass adoption of AWGs, water that evaporates from the ocean and contains microplastics will pass through the device's filters, which will remove all pollutants. The substances remaining in the filter will then be recycled and reused. Removing these pollutants will restore the ocean's ability to dissipate heat from the Earth's crust into the atmosphere and further into space. Also, the thermal conductivity of the atmosphere will improve, which means that heat will be dissipated into space more efficiently as the atmosphere becomes free of excess moisture, methane, and CO2.

Currently, a decrease in the density and lowering of the upper layers of the atmosphere have been recorded. Whereas with intensive extraction of moisture from the atmosphere, it will normalize by height, and its upper layers will become more dense. The amount of moisture in the atmosphere will also become stabilized, which will reduce the occurrence of extreme precipitation and winds. This will become possible with a complete transition from the current consumption of surface and groundwater to the use of atmospheric water obtained from these devices at both the domestic and industrial levels.

Let's explore the necessary steps for restoring moisture and heat exchange between the ocean, atmosphere, and Earth's crust.

The first stage should involve a complete transition to the use of atmospheric water generators (AWG) throughout the planet. This will eliminate the need to extract water from surface and underground sources. AWGs can produce the necessary amount of water for both drinking and industrial needs. They will become vital in the context of a water crisis and will ensure the resilience of water supplies, allowing for the full realization of several United Nations Sustainable Development Goals such as:

- **Goal 6.** Ensure access to water and sanitation for all.
- **Goal 9.** Build resilient infrastructure, promote sustainable industrialization and foster innovation.
- **Goal 13.** Take urgent action to combat climate change and its impacts.
- **Goal 14.** Conserve and sustainably use the oceans, seas and marine resources.
- **Goal 15.** Sustainably manage forests, combat desertification, halt and reverse land degradation, halt biodiversity loss.
- **Goal 17.** Revitalize the global partnership for sustainable development.

The second important step will be the adoption of fuel-free generators (FFG), which are essential to provide AWGs with the necessary and affordable power due to their high power consumption. Moreover, the moisture for water generation plants must be replenished from natural sources, which must be purified beforehand.

For this purpose, open water reservoirs should also be eliminated, along with dams. It is the introduction of FFGs that will reduce dependence on hydropower and provide an opportunity to open dams. Rivers will return to their natural channels, restoring their natural flow. This will eliminate water stagnation and bring rivers back to life, ensuring the flow of clean water into the ocean, and will prevent pollutants from entering the ocean from the continents.

These measures will also help achieve a range of the following Sustainable Development Goals, as adopted by the United Nations General Assembly:

- **Goal 7.** Ensure access to affordable, reliable, sustainable and modern energy.
- **Goal 8.** Promote inclusive and sustainable economic growth, employment and decent work for all.
- **Goal 9.** Build resilient infrastructure, promote sustainable industrialization and foster innovation.
- **Goal 11.** Make cities inclusive, safe, resilient and sustainable.
- **Goal 13.** Take urgent action to combat climate change and its impacts.

At the third stage of restoring moisture and heat exchange between the ocean, atmosphere, and Earth's surface, it is necessary to reconstruct sewage systems. Wastewater should not be dumped into open water bodies. It should flow into the soil, undergoing natural purification through soil layers before reaching water bodies.

The proposed research and practical approaches can become a new scientific and technical revolution. They are aimed at ensuring sustainable water supply and balanced use of water resources. But most importantly, they will reduce the negative impact on the planet's climate system. These measures have a huge potential to significantly change the environmental situation, making our planet more resilient to climate challenges.

The anticipated effect of extracting water from the atmosphere is estimated as follows: 70% of the problems related to climate deterioration can be solved by extracting water from the atmosphere. The remaining 30% of the problems will be solved by wastewater treatment, therefore, this task is also of primary importance.

If the proposed measures are implemented, according to preliminary estimates, tangible results will become noticeable in 2-3 years. The situation may aggravate during the first year after implementation, but in about 8 to 14 months the heat and moisture exchange between the ocean and the atmosphere will start to improve. The first positive results should be expected in 2 years. Nature will begin to revitalize and atmospheric phenomena will become more balanced. In 5 to 8 years, it will become clearly visible how much the waters will begin to purify. This will restore the ocean's function of cooling the planet. Floods and droughts will become a thing of the past, and unwanted winds and temperature swings will decrease. The climate is expected to become milder and more predictable.

However, it is important to understand that these measures will not solve the problem of geodynamic disasters, as the cause of these changes is not in the atmosphere.

The widespread implementation of AWGs will only be able to mitigate the effects of climate change and accelerate the restoration of the planet's environment, provided that we protect the planet from the external cosmic influence.

CONCLUSIONS

Proportional to the increase in the frequency and intensity of natural disasters, the economic losses will also increase worldwide. It is extremely important to calculate the potential damage from upcoming climate disasters by taking into account the exponential progression that corresponds to the global trend of increasing cataclysms.

Thus, the more intense and widespread extreme climatic events are, the higher the probability of surge in prices is, and the less stable the economy of the entire world becomes. This is especially important in the context of global catastrophes caused by geodynamic and anthropogenic factors that have been described in this report.

An effective solution to this problem requires international cooperation of scientists who can join their efforts and resources for developing and taking comprehensive measures. Today, contemporary science is divided and fragmented into narrow-purpose scientific fields and disciplines that do not closely collaborate. In such conditions of global disunity, it is naturally impossible to comprehensively analyze and fully investigate the current planetary threat. If conditions for open cooperation are created, scientists will not have to start from scratch, since there already exist real developments and an understanding of cause-and-effect relationships in this area.

Now, it is necessary to act promptly and use the remaining time wisely.

Appendix 1
The Method of Merging Earthquake Databases

We gathered earthquake data from multiple databases such as International Seismological Center (ISC)[78], United States Geological Survey (USGS)[79], Incorporated Research Institutions for Seismology (IRIS)[80], European-Mediterranean Seismological Center (EMSC)[81], and earthquake aggregation resource Volcano Discovery (VD)[82]. To get the most complete view of the earthquake situation, we create a database which merges events from all these sources. Naturally, some events are present in multiple databases, so we want to identify such identical events and group them while merging. Each seismological agency, however, assesses the earthquake parameters, such as, the hypocenter, the time of the earthquake, and its magnitude using their own algorithms and particular sets of seismographs. Therefore, a strict and accurate comparison of events using only time, hypocenter and magnitude parameters is impossible. We employ the fuzzy matching method of events between two databases using the following algorithm.

We define event A in the first database D_1 possibly related with the event B from the second database D_2 if distance of their epicenters ($D_{diff}(A,B)$) is less than or equal to 300 km, the difference in the time of event ($T_{diff}(A,B)$) is less than 90 seconds and the difference in estimated magnitude ($M_{diff}(A,B)$) is less than or equal to 1. There are several different types of earthquake magnitudes, for example, in the ISC catalog, multiple magnitude estimates are presented for the same event. Therefore, $M_{diff}(A,B)$ is defined as the minimum difference of magnitudes min(abs(Ma-Mb)) where Ma is a magnitude of event A and Mb is a magnitude of event B constrained by the following algorithm:

If A and B have Mw type of magnitudes, then Ma and Mb are selected from the Mw types;

Else if A and B have Ms type of magnitudes, then Ma and Mb are selected from Ms types;

Else if A and B have mb type of magnitudes, then Ma and Mb are selected from mb types;

Else if A and B have ML type of magnitudes, then Ma and Mb are selected from ML types;

in all other cases: any magnitude from A and any magnitude from B are chosen to fulfill the condition: abs(Ma-Mb) is minimal.

For two related events A and B, we define the value of their relationship as:

$$V(A,B) = 36 - 16*T_{diff}(A,B)^2/8100 - 16*D_{diff}(A,B)^2/90000 - 4*M_{diff}(A,B)^2,$$

where $T_{diff}(A,B)$ is measured in seconds, $D_{diff}(A,B)$ is measured in kilometers, and $M_{diff}(A,B)$ is measured in magnitudes. For two totally identical events A and B, the value of V(A,B) equals 36. For two events A and B on the boundary of being possibly related, the value of V(A,B) equals 0.

[78] ISC Bulletin: event catalogue search http://www.isc.ac.uk/iscbulletin/search/catalogue/
[79] USGS Search Earthquake Catalog https://earthquake.usgs.gov/earthquakes/search/
[80] IRIS Wilber 3: Select Event http://ds.iris.edu/wilber3/find_event
[81] EMSC Search earthquakes https://www.emsc-csem.org/Earthquake_information/
[82] Volcano Discovery Earthquakes https://www.volcanodiscovery.com/earthquakes/lists.html

To find a match between events in databases D_1 and D_2, it is necessary that each event from one database corresponds to no more than one event from the other database, and that the sum of all values V(A,B) for the selected pairs of events be maximal.

Technically, we can define a graph G with the set of vertices formed by all events in D1 and D2 and the set of edges formed by pairs of events that are possibly related. The value of an edge between vertices A and B is set to V(A,B). The optimization problem we formulated above is known as maximum weight matching in bipartite graphs and can be solved by standard algorithms[83].

From the algorithm, we get maximum weight matching between events in D_1 and D_2 and we consider the matched events to be identical. Thus the merged database D_m is formed from events in D_1 and non-matching events in D_2. If an event in D_1 is matched to some event in D_2, the magnitude estimate of the matched event in D_2 is added to the set of magnitude estimates for the matched event in D_m.

By starting with the ISC database and sequentially merging databases of USGS, IRIS, EMSC and Volcano Discovery (VD) to it, we have obtained the final merged database (Merged).

For plotting various graphs comparing earthquake counts in different databases, we usually need to constrain the data to a certain range of magnitudes. To avoid differences in earthquake counts due to the differing magnitude estimates among databases we use the merged database to select events in a given magnitude range and plot the graphs (because the merged database may contain multiple magnitude estimates for one event, it is not obvious which estimate to use for selection). There are two different approaches we employ:

1. The first method is to include an event into a selection of events if any magnitude estimate for the event falls in the desired magnitude range.
2. The second, more complex, method is to select a preferred magnitude estimate and include the event into a selection if the preferred estimate is in the desired magnitude range. We select the preferred magnitude estimate by looking for the following magnitude types among the estimates (in the order of preference): Mw, ML, MS, mb, MVD (this is the magnitude estimate coming from the Volcano Discovery database because the magnitude type is not available in that database), MD, and MV. If any magnitude estimate of a given type is found for one event, then all magnitude estimates of the selected type for that event are used. Then the median is calculated for them, and an estimate with the median value is selected. If there is no estimate of any of the above types (which is rare, only a few percent of all events in the entire database), then any type of magnitude value coinciding with the median value calculated for all magnitudes of this event is selected.

The difference in the obtained event counts when using the first and the second method of selecting events in a given magnitude range is insignificant , as a rule, no more than a few percent.

For the graph of the number of earthquakes per year (Figures 7,9) in each database, the first method of selecting events from the merged database was used. For graphs of the number of unique seismic events (Figure 10) present in different databases, the second method of earthquake selection within a specified magnitude range was used.

[83] Nitish Korula, Combinatorial Optimization. Maximum Weight Matching in Bipartite Graphs https://courses.engr.illinois.edu/cs598csc/sp2010/lectures/lecture10.pdf

References

Alexeev, G. V., Borovkov, M. I., & Titova, N. E. (2018). Sovremennye sredstva dlja ochistki vody ot maslo-zhirovyh jemul'sij i nefteproduktov. [Modern means of purifying water from oil-fat emulsions and petroleum products]. Colloquium-journal, 7(18), 4-6.

Alken, P., Thébault, E., Beggan, C.D. et al. (2021). International Geomagnetic Reference Field: the thirteenth generation. Earth Planets Space 73, 49. https://doi.org/10.1186/s40623-020-01288-x

Androsova, N. K., Baranova, T. I., & Semykina D.V. (2020). Geological past and present of the Earth's magnetic poles. EARTH SCIENCES/ "Colloquium-journal", 5(57). DOI:10.24411/2520-6990-2020-11388

AON. (2023). Weather, Climate and Catastrophe Insight. https://www.aon.com/getmedia/f34ec133-3175-406c-9e0b-25ce-a768c5cf/20230125-weather-climate-catastrophe-insight.pdf, p.42.

Arushanov, M. L. (2023). Causes of Earth climate change, as a result of space impact, dispelling the myth about anthropogenic global warming. Deutsche Internationale Zeitschrift Für Zeitgenössische Wissenschaft, 53, 4–14.
https://doi.org/10.5281/zenodo.7795979

Arushanov, M. L. (2023). Dinamika klimata. Kosmicheskie faktory. [Climate Dynamics. Cosmic Factors]. Hamburg: LAMBERT Academic Publishing.

Aubourg, L., (2024, January 12). Editors' notes 2023's record heat partly driven by 'mystery' process: NASA scientist https://phys.org/news/2024-01-driven-mystery-nasa-scientist.html

Barkin, Yu.V. (2009). Ciklicheskie inversionnye izmenenija klimata v severnom i juzhnom polusharijah Zemli [Cyclic Inversion Climate Change in the Northern and Southern Hemispheres of Earth]. Geology of the Seas and Oceans: Materials of the XVIII International Scientific Conference (School) on Marine Geology. Vol. III. - Moscow: GEOS. pp. 4-8.

Barkin, Yu.V., & Barkin, M. Yu., (2014). Novaja analiticheskaja teorija vrashhenija Zemlistat'ja [New Analytical Theory of Earth's Rotation]. Engineering Journal: Science and Innovation, 12(36). https://istina.msu.ru/publications/article/7735956/

Barkin, Yu. V. & Smolkov, G. Ya. (2013). Abrupt changes in the trends of geodynamic and geophysical phenomena in 1997-1998. In All-Russian Conf. on Solar-Terrestrial Physics, dedicated to the 100th anniversary of the birth of a corresponding member of the Russian Academy of Sciences Stepanov V.E. (September 16-21, 2013, Irkutsk), Irkutsk, 2013.

Barletta, V. R., Bevis, M., Smith, B. E., Wilson, T., Brown, A., Bordoni, A., Willis, M., Khan, S. A., Rovira-Navarro, M., Dalziel, I., Smalley, R., Kendrick, E., Konfal, S., Caccamise, D. J., Aster, R. C., Nyblade, A., & Wiens, D. A. (2018). Observed rapid bedrock uplift in Amundsen Sea Embayment promotes ice-sheet stability. Science, 360(6395), 1335–1339. https://doi.org/10.1126/science.aao1447

Baturin, A. M. (2001). Periodichnost globalnykh katastrof - 12166 let. [Periodicity of Global Catastrophes - 12166 years"] Monograph. Kursk CSTI.

Belozerov, I. M. (2008). Nature as viewed by a physicist. International Scientific Journal for Alternative Energy and Ecology, 12(68). https://cyberleninka.ru/article/n/priroda-glazami-fizika/viewer

Bowling, J. S., Livingstone, S. J., Sole, A. J., & Chu, W. (2019). Distribution and dynamics of Greenland subglacial lakes. Nature Communications, 10(2810). https://doi.org/10.1038/s41467-019-10821-w

Briner, J. P., Cuzzone, J. K., Badgeley, J. A., Young, N. E., Steig, E. J., Morlighem, M., Schlegel, N.-J., Hakim, G. J., Schaefer, J. M., Johnson, J. V., Lesnek, A. J., Thomas, E. K., Allan, E., Bennike, O., Cluett, A. A., Csatho, B., de Vernal, A., Downs, J., Larour, E., & Nowicki, S. (2020). Rate of mass loss from the Greenland Ice Sheet will exceed Holocene values this century. Nature, 586(7827), 70–74. https://doi.org/10.1038/s41586-020-2742-6

Broquet, A., & Andrews-Hanna, J. C. (2022). Geophysical evidence for an active mantle plume underneath Elysium Planitia on Mars. Nature Astronomy, 7, 160–169. https://doi.org/10.1038/s41550-022-01836-3

Brown, S. K., Crosweller, H. S., Sparks, R. S. J., Cottrell, E., Deligne, N. I., Guerrero, N. O., Hobbs, L., Kiyosugi, K., Loughlin, S. C., Siebert, L., & Takarada, S. (2014). Characterisation of the Quaternary eruption record: analysis of the Large Magnitude Explosive Volcanic Eruptions (LaMEVE) database. Journal of Applied Volcanology, 3(5).
https://doi.org/10.1186/2191-5040-3-5

Bryson, R. A. (1989). Late quaternary volcanic modulation of Milankovitch climate forcing. Theoretical and Applied Climatology, 39, 115–125. https://doi.org/10.1007/bf00868307

Bushuev, E. V., & Kopylov, I. P. (2005). Kosmos i Zemlja. Elektromekhanicheskie vzaimodejstvija. [Space and Earth. Electromechanical Interactions]. Monograph. Moscow: Energy.

Canadell, J., Meyer, C., Cook, G., Dowdy, A., Briggs, P., Knauer, J., Pepler, A. & Haverd, V. (2021). Multi-decadal increase of forest burned area in Australia is linked to climate change. Nature Communications, 12, 6921. https://doi.org/10.1038/s41467-021-27225-4

Cesca, S., Sugan, M., Rudzinski, Ł., Vajedian, S., Niemz, P., Plank, S., Petersen, G., Deng, Z., Rivalta, E., Vuan, A., Plasencia Linares, M. P., Heimann, S., & Dahm, T. (2022). Massive earthquake swarm driven by magmatic intrusion at the Bransfield Strait, Antarctica. Communications Earth & Environment, 3(1). https://doi.org/10.1038/s43247-022-00418-5

Chadwick, J., Keller, R., Kamenov, G., Yogodzinski, G., & Lupton, J. (2014). The Cobb hot spot: HIMU-DMM mixing and melting controlled by a progressively thinning lithospheric lid. Geochemistry, Geophysics, Geosystems, 15(8), 3107–3122. https://doi.org/10.1002/2014gc005334

Channell, J. E. T., & Vigliotti, L. (2019). The role of geomagnetic field intensity in Late Quaternary evolution of humans and large mammals. Reviews of Geophysics, 57. https://doi.org/10.1029/2018RG000629

Cheng, L., Abraham, J., Zhu, J., Trenberth, K. E., Fasullo, J., Boyer, T., Locarnini, R., Zhang, B., Yu, F., Wan, L., Chen, X., Song, X., Liu, Y., & Mann, M. E. (2020). Record-Setting Ocean Warmth Continued in 2019. Advances in Atmospheric Sciences, 37(2), 137–142. https://doi.org/10.1007/s00376-020-9283-7

Copernicus. (2024, January 9) Copernicus: 2023 is the hottest year on record, with global temperatures close to the 1.5°C limit https://climate.copernicus.eu/copernicus-2023-hottest-year-record

Cox, C., & Chao, B. F. (2002). Detection of a large-scale mass redistribution in the terrestrial system since 1998. Science, 297(5582), 831–833. https://doi.org/10.1126/science.1072188

Dahmen, N., Clinton, J. F., Meier, M., Stähler, S., Ceylan, S., Kim, D., Stott, A. E., & Giardini, D. (2022). MarsQuakeNet: A more complete marsquake catalog obtained by deep learning techniques. Journal of Geophysical Research: Planets, 127(11).

https://doi.org/10.1029/2022je007503

Damiani, T. M., Jordan, T. A., Ferraccioli, F., Young, D. A., & Blankenship, D. D. (2014). Variable crustal thickness beneath Thwaites Glacier revealed from airborne gravimetry, possible implications for geothermal heat flux in West Antarctica. Earth and Planetary Science Letters, 407, 109–122. https://doi.org/10.1016/j.epsl.2014.09.023

Danilov, A. D., & Konstantinova, A. V. (2014). Reduction of the atomic oxygen content in the upper atmosphere. Geomagnetizm i Aeronomija. [Geomagnetism and Aeronomy], 54(2), 224–229. https://doi.org/10.1134/s0016793214020066

Danilov, A.D., Konstantinova, A.V. (2020). Long-Term Variations in the Parameters of the Middle and Upper Atmosphere and Ionosphere (Review). Geomagnetizm i Aeronomija [Geomagnetism and Aeronomy], 60; 397–420. https://doi.org/10.1134/S0016793220040040

Davidson, B. (2021). The next end of the world. Space Weather News. ISBN 9781098357788

Deng, S., Liu, S., Mo, X., Jiang, L., & Bauer-Gottwein, P. (2021). Polar Drift in the 1990s Explained by Terrestrial Water Storage Changes. Geophysical Research Letters, 48(7).

https://doi.org/10.1029/2020gl092114

Dyachenko, A. I. (2003). Magnetic Poles of the Earth. Moscow: MCCME. 48 p.

Dziadek, R., Ferraccioli, F., & Gohl, K. (2021). High geothermal heat flow beneath Thwaites Glacier in West Antarctica inferred from aeromagnetic data. Communications Earth & Environment, 2(16). https://doi.org/10.1038/s43247-021-00242-3

Earth Observatory. (n.d). Antarctic warming trends. https://earthobservatory.nasa.gov/images/36736/antarctic-warming-trends

Easterbrook, D. J. (2016). Evidence-based climate science, data opposing CO2 emissions as the primary source of global warming, (2nd Ed.) Elsevier. Bellingham, USA.

https://doi.org/10.1016/C2015-0-02097-4

EM-DAT. (n.d.). Inventorying hazards & disasters worldwide since 1988. https://www.emdat.be

Emmert, J. T., Lean, J. L., & Picone, J. M. (2010). Record-low thermospheric density during the 2008 solar minimum. Geophysical Research Letters, 37(12). https://doi.org/10.1029/2010gl043671

EMSC. (n.d.). EMSC Search earthquakes. https://www.emsc-csem.org/Earthquake_information/

Fernando, B., Daubar, I. J., Charalambous, C., Grindrod, P. M., Stott, A., Abdullah Al Ateqi, Atri, D., Ceylan, S., Clinton, J., Fillingim, M. O., Hauber, E., Hill, J. R., Kawamura, T., Li, J., Lucas, A., Lorenz, R. D., Ojha, L., Perrin, C., S. Piqueux, & Stähler, S. C. … Banerdt, W. B. (2023). A tectonic origin for the largest marsquake observed by InSight. Geophysical Research Letters, 50(20). https://doi.org/10.1029/2023gl103619

Frattasi, P. (2023, May 8). Ai Campi Flegrei 675 terremoti ad aprile 2023: è il mese con più scosse degli ultimi 20 anni. [At the Phlegraean Fields, 675 earthquakes in April 2023: it is the month with the most tremors in the last 20 years]. Fangage.it

https://www.fanpage.it/napoli/campi-flegrei-675-terremoti-aprile-2023/

Gase, A., Bangs, N. L., Saffer, D. M., Han, S., Miller, P., Bell, R., Arai, R., Henrys, S. A., Shiraishi, K., Davy, R., Frahm, L., & Barker, D. (2023). Subducting volcaniclastic-rich upper crust supplies fluids for shallow megathrust and slow slip. Science Advances, 9(33). https://doi.org/10.1126/sciadv.adh0150

GeoNet. (2022, December 2). Strong M5.6 earthquake consistent with continued minor volcanic unrest at Taupō. Volcanic Alert Level remains at Level 1. Volcanic Activity Bulletin. https://www.geonet.org.nz/vabs/7tu66lDztDnlaYDG0LYSgl

Geyer, R., Jambeck, J. R., & Law, K. L. (2017). Production, use, and fate of all plastics ever made. Science Advances, 3(7). https://doi.org/10.1126/sciadv.1700782

Givishvili, G. V. & Leshchenko, L. N. (2022). Long-term trend of the ionospheric E-layer response to solar flares. Solnechno-Zemnaya Fizika [Solar-Terrestrial Physics], 8(1): 51–57.

https://doi.org/10.12737/szf-81202206

Givishvili, G. V. & Leshchenko, L. N. (2022). On the causes of cooling and settling of the middle and upper atmosphere. Izvestija. RAN. Fizika atmosfery i okeana. [News. Russian Academy of Sciences. Atmospheric and Ocean Physics], 58(5), 601-614. https://doi.org/10.31857/S0002351522050042

Gorny, V. I. et al. (2001) Model of the mantle-lithospheric interaction based on data from Uralseys Geotraverse for prospecting seismology and remote geothermal method. Deep structure and geodynamics of the Southern Urals. Tver. pp. 227-238.

Hapgood, C. H. (1958). Earth's shifting crust: A key to some basic problems of earth science. Pantheon Books, - Science.

Heinrich, H. (1988). Origin and consequences of cyclic ice rafting in the Northeast Atlantic Ocean during the past 130,000 years. Quaternary Research, 29(2), 142–152. https://doi.org/10.1016/0033-5894(88)90057-9

Hruzdov, V. I. (October 2021). Nejtronnaja Vselennaja, Gl. 10. Raschjot nejtronnogo jadra Zemli [Neutron Universe. Ch. 10. Calculation of the Earth's neutron core]. Moscow: Libmonster Russia. Retrieved from: https://libmonster.ru/m/articles/download/17227/4846

Hughes, T. P., Kerry, J. T., Baird, A. H., Connolly, S. R., Dietzel, A., Eakin, C. M., Heron, S. F., Hoey, A. S., Hoogenboom, M. O., Liu, G., McWilliam, M. J., Pears, R. J., Pratchett, M. S., Skirving, W. J., Stella, J. S., & Torda, G. (2018). Global warming transforms coral reef assemblages. Nature, 556, 492–496.

https://doi.org/10.1038/s41586-018-0041-2

IERS Earth Orientation Center of the Paris Observatory. (n.d.).

Length of day — Earth Orientation Parameters: https://datacenter.iers.org/singlePlot.php?plotname=EOPC04_14_62-NOW_IAU1980-LOD&id=223

International Seismological Centre. (n.d.). Bulletin of the International Seismological Centre. http://www.isc.ac.uk/iscbulletin https://doi.org/10.31905/D808B830

IRIS. (n.d.). IRIS Wilber 3: Select Event http://ds.iris.edu/wilber3/find_event

Kamis, J. E., (n.d.). Geologically induced northern atlantic ocean "warm blob" melting Southern Greenland ice sheet. Plate Climatology. https://www.plateclimatology.com/geologically-induced-northern-atlantic-ocean-warm-blob-melting-southern-greenland-ice-sheet

Kamis, J. E., (2016, November 3). West Antarctic glacial melting from deep earth geological heat flow not global warming. Plate Climatology. https://www.plateclimatology.com/west-antarctic-glacial-melting-from-deep-earth-geological-heat-flow-not-global-warming

Khalilov, E. (Ed.). (2010). Global changes of the environment: Threatening the progress of civilization. GEOCHANGE: Problems of Global Changes of the Geological Environment, 1, London, ISSN 2218-5798.

Kopylov, I. (2001, November 1) Elektromekhanika Solnechnoj sistemy [Electromechanics of the solar system]. NVO.

Korula, N. (2010, February 18). Combinatorial Optimization. Maximum Weight Matching in Bipartite Graphs. Lecture in CS 598CSC: Combinatorial Optimization. https://courses.engr.illinois.edu/cs598csc/sp2010/lectures/lecture10.pdf

Laufkötter, C., Zscheischler, J., & Frölicher, T. L. (2020). Science, 369(6511), 1621–1625. https://doi.org/10.1126/science.aba0690

Lebreton, L., Egger, M., & Slat, B. (2019). A global mass budget for positively buoyant macroplastic debris in the ocean. Scientific Reports, 9, 12922. https://doi.org/10.1038/s41598-019-49413-5

Li, S., Li, Y., Zhang, Y., Zhou, Z., Guo, J., & Weng, A. (2023). Remnant of the late Permian superplume that generated the Siberian Traps inferred from geomagnetic data. Nature Communications, 14, 1311. https://doi.org/10.1038/s41467-023-37053-3

Livermore, P. W., Hollerbach, R., & Finlay, C. C. (2017). An accelerating high-latitude jet in Earth's core. Nature Geoscience, 10, 62–68. https://doi.org/10.1038/ngeo2859

Loose, B., Naveira Garabato, A. C., Schlosser, P., Jenkins, W. J., Vaughan, D., & Heywood, K. J. (2018). Evidence of an active volcanic heat source beneath the Pine Island Glacier. Nature Communications, 9(2431). https://doi.org/10.1038/s41467-018-04421-3

Lübken, F.-J., Berger, U., & Baumgarten, G. (2013). Temperature trends in the midlatitude summer mesosphere. Journal of Geophysical Research: Atmospheres, 118(24), 13,347–13,360. https://doi.org/10.1002/2013jd020576

Lushvin, P., (2018, March 27). Prirodnye ravninnye pozhary i kak ih minimizirovat' — 2 [Natural Grassland Fires and How to Minimize Them — 2]. Regnum. https://regnum.ru/article/2395754

Lushvin, P., (2019). Natural Plain Fires and How to Minimize Them. Presentation at the 26th meeting of the All-Russian Interdisciplinary Seminar-Conference of the Geological and Geographical Faculties of Moscow State University "Planet Earth System," January 30 — February 2, 2018.

Lushvin, P., Buyanova, M. (2021). Development of ice cover in water areas during methane. International Journal of Geosciences, 12(9), 927-940.

https://doi.org/10.4236/ijg.2021.129047

Lushvin, P., Buyanova, M. (2021). History of observations of seismogenic phenomena in the atmosphere and formalization of their decryption. International Journal of Atmospheric and Oceanic Sciences, 5(1), 13-19.

https://doi.org/10.11648/j.ijaos.20210501.13

Malinin V. N. & Vaynovsky P. A. (2021). Trends of moisture exchange components in the ocean-atmosphere system under global warming conditions", Reanalysis-2. Sovremennye problemy distancionnogo zondirovaniâ Zemli iz kosmosa [Current problems in remote sensing of the Earth from space] 18(3), 9-25. DOI: 10.21046/2070–7401–2021–18–3–9–25

Meinen, C. S., Perez, R. C., Dong, S., Piola, A. R., & Campos, E. (2020). Observed ocean bottom temperature variability at four sites in the northwestern argentine basin: Evidence of decadal deep/abyssal warming amidst hourly to interannual variability during 2009–2019. Geophysical Research Letters, 47(18). https://doi.org/10.1029/2020gl089093

Mersereau, D., (2023, September 9). A world first, every tropical ocean saw a Category 5 storm in 2023. The Weather Network. https://www.theweathernetwork.com/en/news/weather/severe/a-world-first-every-tropical-ocean-saw-a-category-5-hurricane-cyclone-in-2023

Mikhaylova R.S. (2014). Strong earthquakes in the mantle and their impact in the near and far zone. Geophysical Service of the Russian Academy of Sciences. http://www.emsd.ru/conf2013lib/pdf/seism/Mihaylova.pdf

Mikhailova, R. S., Ulubieva, T. R., & Petrova N. V. (2021). The Hindu Kush earthquake of October 26, 2015, with Mw=7.5, I0~7: Preceding Seismicity and Aftershock Sequence. Earthquakes of Northern Eurasia, 24, 324–339.
https://doi.org/10.35540/1818-6254.2021.24.31

Morton, A. (2019, December 27). Hot blob: vast patch of warm water off New Zealand coast puzzles scientists. The Guardian. https://www.theguardian.com/world/2019/dec/27/hot-blob-vast-and-unusual-patch-of-warm-water-off-new-zealand-coast-puzzles-scientists

National Oceanic and Atmospheric Administration (NOAA) (2024). NOAA National Centers for Environmental Information (NCEI) U.S. Billion-Dollar Weather and Climate Disasters.
(https://www.ncei.noaa.gov/access/billions/), DOI: 10.25921/stkw-7w73

Nippon. (2018, May 16). Sakurajima, Japan's Most Active Volcano. https://www.nippon.com/en/features/h00194/

Oppo, D. (2013, October 31). Is global heating hiding out in the oceans? Columbia Climate School.
The Earth Institute. https://www.earth.columbia.edu/articles/view/3130

Ostle, C., Thompson, R. C., Broughton, D., Gregory, L., Wootton, M., & Johns, D. G. (2019). The rise in ocean plastics evidenced from a 60-year time series. Nature Communications, 10(1622). https://doi.org/10.1038/s41467-019-09506-1

Otosaka, I. N., Horwath, M., Mottram, R. & Nowicki, S. (2023). Mass Balances of the Antarctic and Greenland Ice Sheets Monitored from Space. Surveys in Geophysics, 44:1615–1652.
https://doi.org/10.1007/s10712-023-09795-8

Petrov, N. V. (2015). The Climate of the Earth: The solution to the problem of climate change of the Earth from the position of the law the preservation of life in space. Ecology and Society Development: Journal of the International Academy of Ecology, Human and Nature Safety Sciences, 4, 11-23.
http://www.trinitas.ru/rus/doc/0016/001d/2551-ptr.pdf

Pisoft, P., Sacha, P., Polvani, L. M., Añel, J. A., de la Torre, L., Eichinger, R., Foelsche, U., Huszar, P., Jacobi, C., Karlicky, J., Kuchar, A., Miksovsky, J., Zak, M., & Rieder, H. E. (2021). Stratospheric contraction caused by increasing greenhouse gases. Environmental Research Letters, 16, 064038.
https://doi.org/10.1088/1748-9326/abfe2b

PMODWRC. (n.d.). Solar Constant: Construction of a Composite Total Solar Irradiance (TSI) Time-Series from 1978 to the Present https://www.pmodwrc.ch/en/research-development/solar-physics/tsi-composite/

Reteyum, A. Yu. (2020, April 11). Epidemii v obstanovke bol'shogo solnechnogo minimuma [Epidemics in the context of a major solar minimum]. Regnum. https://regnum.ru/article/2913426

Reteyum, A. Yu. (2020, April 11). Opasnyj mif antropogennogo poteplenija [The dangerous myth of anthropogenic warming]. Regnum. https://regnum.ru/article/3101660

Rezvanbehbahani, S., Stearns, L. A., Kadivar, A., Walker, J. D., & van der Veen, C. J. (2017). Predicting the geothermal heat flux in Greenland: A machine learning approach. Geophysical Research Letters, 44(24), 12,271-12,279.
https://doi.org/10.1002/2017gl075661

Rogozhina, I., Petrunin, A. G., Vaughan, A. P. M., Steinberger, B., Johnson, J. V., Kaban, M. K., Calov, R., Rickers, F., Thomas, M., & Koulakov, I. (2016). Melting at the base of the Greenland ice sheet explained by Iceland hotspot history. Nature Geoscience, 9, 366–369. https://doi.org/10.1038/ngeo2689

Romagnoli, C., Zerbini, S., Lago, L., Richter, B., Simon, D., Domenichini, F., Elmi, C., & Ghirotti, M. (2003). Influence of soil consolidation and thermal expansion effects on height and gravity variations. Journal of Geodynamics, 35(4-5), 521–539.
https://doi.org/10.1016/S0264-3707(03)00012-7

Rosenthal, Y., Linsley, B. K., & Oppo, D. W. (2013). Pacific ocean heat content during the past 10,000 years. Science, 342(6158), 617–621. https://doi.org/10.1126/science.1240837

Rysgaard, S., Bendtsen, J., Mortensen, J., & Sejr, M. K. (2018). High geothermal heat flux in close proximity to the Northeast Greenland Ice Stream. Scientific Reports, 8(1344). https://doi.org/10.1038/s41598-018-19244-x

Sawyer, D. E., Urgeles, R., & Lo Iacono, C. (2023). 50,000 yr of recurrent volcaniclastic megabed deposition in the Marsili Basin, Tyrrhenian Sea. Geology, 51(11), 1001–1006. https://doi.org/10.1130/g51198.1

Seroussi, H., Ivins, E. R., Wiens, D. A., & Bondzio, J. (2017). Influence of a West Antarctic mantle plume on ice sheet basal conditions. Journal of Geophysical Research: Solid Earth, 122(9), 7127–7155. https://doi.org/10.1002/2017jb014423

Seroussi, H., Morlighem, M., Rignot, E., Mouginot, J., Larour, E., Schodlok, M., & Khazendar, A. (2014). Sensitivity of the dynamics of Pine Island Glacier, West Antarctica, to climate forcing for the next 50 years. The Cryosphere, 8(5), 1699–1710. https://doi.org/10.5194/tc-8-1699-2014

Smolkov, G. Ya. (2018). Exposure of the solar system and the earth to external influences. Physics & Astronomy International Journal, 2(4), 310–321. https://doi.org/10.15406/paij.2018.02.00104

Smotrin E. G., candidate of military sciences. (1998). Natural disasters and catastrophes — the main threat to planetary and Eurasian security upon entering the 3rd millennium AD. Geostrategy and Technologies XXI.
http://www.geost-21.su/ru/node/1

Strass, V. H., Rohardt, G., Kanzow, T., Hoppema, M., & Boebel, O. (2020). Multidecadal warming and density loss in the Deep Weddell Sea, Antarctica. Journal of Climate, 33(22), 9863–9881. https://doi.org/10.1175/jcli-d-20-0271.1

Sun, D., Li, F., Jing, Z., Hu, S., & Zhang, B. (2023). Frequent marine heatwaves hidden below the surface of the global ocean. Nature Geoscience, 16(12), 1099–1104. https://doi.org/10.1038/s41561-023-01325-w

Sun, W., & Tkalčić, H. (2022). Repetitive marsquakes in Martian upper mantle. Nature Communications, 13, 1695. https://doi.org/10.1038/s41467-022-29329-x

Swiss Re Institute. (2023, December 14). Natural catastrophes in focus: Tornados, hail and thunderstorms. https://www.swissre.com/risk-knowledge/mitigating-climate-risk/tornados-hail-thunderstorms.html

Tarasov, L. V. (2012) Earth magnetism: A textbook. Dolgoprudny: Intellect Publishing House, 184 p.

Thomas, C. (1993). The Adam & Eve story: The history of cataclysms. Bengal Tiger Pr.

Toyokuni, G., Matsuno, T., & Zhao, D. (2020). P wave tomography beneath Greenland and surrounding regions: 1. crust and upper mantle. Journal of Geophysical Research: Solid Earth, 125(12). https://doi.org/10.1029/2020jb019837

The IMBIE Team. (2018). Mass balance of the Antarctic Ice Sheet from 1992 to 2017. Nature, 558, 219–222. https://doi.org/10.1038/s41586-018-0179-y

The Watchers. (2023, February 23). Increased seismic activity under Trident volcano, Alaska. https://watchers.news/2023/02/23/increased-seismic-activity-under-trident-volcano-alaska/

van der Veen, C. J., Leftwich, T., von Frese, R., Csatho, B. M., & Li, J. (2007). Subglacial topography and geothermal heat flux: Potential interactions with drainage of the Greenland ice sheet. Geophysical Research Letters, 34(12). https://doi.org/10.1029/2007gl030046

United Nations. (n.d.). Her land. Her rights. https://www.un.org/en/observances/desertification-day

USGS. (n.d.). Search results: Seismic activity in the Mariana Trench region according to USGS data.

https://earthquake.usgs.gov/earthquakes/map/?extent=-15.62304,98.08594&extent=45.39845,196.52344&range=search&search=%7B%22name%22:%22Search%20Results%22,%22params%22:%7B%22starttime%22:%222023-11-23%2000:00:00%22,%22endtime%22:%222023-11-26%2023:59:59%22,%22maxlatitude%22:29.075,%22minlatitude%22:6.49,%22maxlongitude%22:155.215,%22minlongitude%22:133.242,%22minmagnitude%22:2.5,%22orderby%22:%22time%22%7D%7D

USGS. (n.d.). USGS Search Earthquake Catalog. https://earthquake.usgs.gov/earthquakes/search/

Viterito, A. (2022). 1995: An important inflection point in recent geophysical history. International Journal of Environmental Sciences & Natural Resources, 29(5). https://doi.org/10.19080/ijesnr.2022.29.556271

Vogt, D. B. (2007). God's Day of Judgment; The real cause of global warming (1st Ed.). Vector Associates.

Vogt, D. B. (2015). The theory of multidimensional reality. Vector Associates.

Volcano Discovery. (n.d.). Volcano Discovery Earthquakes. https://www.volcanodiscovery.com/earthquakes/lists.html

Volcano Hazards Program. (2015, September 17). Mauna Loa - earthquake and deformation data 2010-2016. https://www.usgs.gov/media/images/mauna-loa-earthquake-and-deformation-data-2010-2016

Vsegei. (n.d.). Tajaniju ldov Grenlandii sposobstvuet Islandskij pljum [The melting of Greenland's ice is facilitated by the Icelandic plume.] https://www.vsegei.ru/ru/about/news/97448/?sphrase_id=1444325

White, K. W. (1992). World in peril: The origin, mission, and scientific findings of the 46th/72nd Reconnaissance Squadron, K. White, ISBN 0962891681.

Yao, F., Livneh, B., Rajagopalan, B., Wang, J., Jean-François Crétaux, Wada, Y., & Berge-Nguyen, M. (2023). Satellites reveal widespread decline in global lake water storage. Science, 380(6646), 743–749. https://doi.org/10.1126/science.abo2812

Yurganov, L. N., Leifer, I., & Sunil Vadakkepuliyambatta. (2017). Evidences of accelerating the increase in the concentration of methane in the atmosphere after 2014: satellite data for the Arctic. Sovremennye problemy distancionnogo zondirovaniâ Zemli iz kosmosa [Current problems in remote sensing of the Earth from Space] 14(5), 248–258.

https://www.researchgate.net/publication/317587506_Evidences_of_accelerating_the_increase_in_the_concentration_of_methane_in_the_atmosphere_after_2014_satellite_data_for_the_Arctic

Zotov, L. V., Barkin, Y. V. & Lyubushin, A. A. (2009). Dvizhenie geocentra i ego geodinamika [The motion of the geocenter and its geodynamics]. In 3rd. conf. Space geodynamics and modeling of global geodynamic processes, Novosibirsk, September 22-26, 2009, Siberian Branch of the Russian Academy of Sciences. (pp. 98-101). Novosibirsk: Geo.