New Long-Term Climate Oscillations

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This paper has been tested for four years in 15 journals. More than a dozen reviewers reviewed it. Therefore, their reviews and my responses to them constitute a **Discussion** that allows the reader to better understand the issues discussed in this paper. Below are details from 13 journals.

In addition, there are many problems in contemporary fundamental science, the main one of which is that science has lost touch with reality. This **Discussion** allows one to understand these problems, which will help to overcome them in the future.

From the next page follows the paper, and after the paper is the **Discussion.**

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ABSTRACT

The astronomical theory of climate change is based on the solution of differential equations describing Earth's orbital and rotational motions. The equations are used to calculate the change in insolation over the Earth's surface. As a result of the author's solution of the orbital problem, the periods and amplitudes of Earth-orbit variations and their evolution have been refined. Unlike previous studies, the equations of Earth's rotational motion are solved completely. The Earth's rotational axis precesses relative to a direction different from the direction of the orbit's axial precession, and oscillates with periods of half a month, half a year and 18.6 years. Also, its oscillations occur with irregular periods of several tens of thousands of years and more. All these motions lead to oscillations of the obliquity in the range of 14.7° to 32.1°, which prove to be 7 - 8 times larger than obtained by a previous theory. In the same proportion, the Earth's insolation oscillations increase in amplitude, with insolation extremes occurring in other epochs than those in the previous theory. The amplitudes and the onset times of the extremes correlate with known paleoclimate changes. Thirteen insolation periods of paleoclimate variation over an interval of 200 thousand years are identified. From the insolation evolution calculated over a time interval of 1 million years, 6 climate gradations from very cold to very warm are identified.

1. INTRODUCTION

Long-term climate oscillations are analyzed in the Astronomical theory of climate change (or alternately named, Astronomical theory of ice ages). The theory is based on the solution of the following three problems: 1) what are the changes in the Earth's orbit? 2) what are the changes in the Earth's axis of rotation? 3) what are the changes in the amount of solar radiation over the Earth's latitude based on the first two changes? The original version of the theory was developed by M. Milankovitch [1] in the first quarter of the 20th century. Subsequently, the proposed approach was improved by other researchers [2-6]. At the end of the 20th century, activities aimed at revisiting the above problems were initiated [7]. As the result of a more precise solution to the problem of Earth's rotational motion, a second version of the climate change theory succeeded in explaining the factors that cause long-term climate oscillations.

This paper presents the main results of the new Astronomical theory of climate change, how they were obtained and their reliability.

2. METHOD

This paper presents the results of decades of theoretical studies. The foundations of mechanics were analyzed, unsubstantiated hypotheses were eliminated and mechanical operations were formulated with regard to their actual content [8]. The differential equations of the orbital motion of planets in the Solar system were redefined, a new method for solving them was developed, and the Galactica program was created for their numerical solution [9-11]. Differential equations for orbital and rotational motion were derived in a new way and a method for analyzing, solving and integrating them was developed. This evolved into a program for their numerical solution [11-13]. Orbital motion was considered in the coordinates associated with the fixed equator of Earth, and rotational motion was investigated in coordinates associated with a fixed plane of the Earth's orbit. Transformations of the parameters of orbital motion relative to the coordinates associated with the plane of the moving equator are derived [14]. The equations for the irradiation of the Earth by the Sun, depending on the parameters of its orbital and rotational motions, are derived in a new way. A program for calculating the Earth insolation has been developed [15]. The numerical integration of these equations on supercomputers has been performed. These tasks are complex and laborious. For example, the integration of the equations of orbital motion over 100 million years took two years of machine time. The analysis of the solutions of these equations was carried out over several years.

These studies are unique, so all their stages were tested. Algorithms for checking the accuracy of solutions were introduced into the programs for integrating equations. For example, there are about two dozen in the Galactica program. All stages of the solution were checked, compared with the observations and conclusions of other researchers. Checking took longer than the solutions themselves. For example, verification of solutions to a problem on the rotation of the Earth was carried out over a period of three years.

3. RESULTS

3.1. Earth's Motions and Their Variations

The Earth moves in an elliptical orbit around the Sun, which is located at one focus of an ellipse (**Figure 1**). The shortest Earth-Sun distance in perihelion is denoted by R_p, and the largest distance in aphelion by R_a. The period of Earth's motion with respect to motionless space connected with the Solar system is P_{sd} = 365.25636042 days [16, 17]. The quantity P_{sd} is called the sidereal period of the Earth's rotation around the Sun. The Earth's orbital motion proceeds in an anticlockwise direction, based on the orbit being viewed from the Earth's North Pole *N*. The normal to the orbital plane is denoted as $\vec{S}$, and is called the orbital axis.

With respect to motionless space, the Earth rotates around its axis, $\vec{N}$ at an angular velocity of ω_E = $7.292115 \cdot 10^{-5}$ 1/sec in an anticlockwise direction coincident with the direction of the Earth's orbital motion. The value of ω_E corresponds to a full revolution performed by the Earth in 0.99726968 days. The Earth's rotational axis $\vec{N}$ is inclined to the orbital axis $\vec{S}$ at an angle equal in the contemporary epoch, to $\varepsilon = 23.43^\circ$. This inclination is called the obliquity. During the orbital motion of Earth, the orientation of its rotational axis $\vec{N}$ remains unchanged in space (**Figure 1**). That is why at two points of the orbit, at times March 20, (20.03), and September 22, (22.09), the axis $\vec{N}$ is normal to the Earth-Sun direction. With respect to Earth, the Sun is in its equatorial plane. That is why the southern and northern hemispheres receive identical amounts of solar radiation and the day appears to be equal in duration to night. These points are called the day of vernal equinox, (20.03), and the day of autumnal equinox, (22.09). At the time, June 21, (21.06), the axis $\vec{N}$ is least inclined to the Earth-Sun line, and the northern hemisphere is therefore illuminated with maximum solar radiation. At the time of December 21, (21.12), the axis, $\vec{N}$

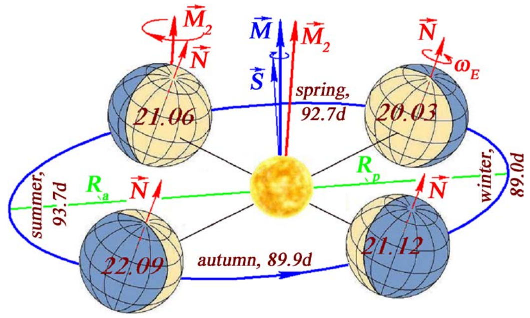

Figure 1. **The Earth's position in its orbit in 2025 during the days of vernal equinox (20.03), summer solstice (21.06), autumnal equinox (22.09), and winter solstice (21.12), and the time expressed in Earth motion during the days in spring (92.7 d), in summer (93.7 d), in autumn (89.9 d), and in winter (89.0 d): $\vec{N}$ is the Earth's axis of rotation; $\vec{M}_2$ is a vector relative to which the axis $\vec{N}$ precesses in a period of 25.74 thousand years; $\vec{S}$ is the Earth's rotational axis, and $\vec{M}$ is a vector relative to which the $\vec{S}$ axis precesses over a period of 68.7 thousand years [14, 15, 18, 19].**

is at maximum inclination to the Earth-Sun line. This is the reason the southern hemisphere is at maximum illumination at that time, and polar night approaches at high latitudes in the northern hemisphere. Since the time spent on reaching and leaving the extreme angles lasts for several days, these points are called respectively, the summer solstice day (21.06), and the winter solstice day (21.12).

The inclination of Earth's axis, $\vec{N}$ to the orbital axis, $\vec{S}$ leads to the variation in duration of sunlight, both during the year and on the same day at different latitudes. On summer solstice day, (**Figure 1**, 21.06), we have a polar day in the whole region between the North Pole and the Arctic Circle. Then, as the latitude decreases, the day gets shorter, reaching a 12-hour duration at the equator, and we have a polar night established below the Antarctic Circle. Contrary to this, on the day of winter solstice, (21.12), in the territory between the North Pole and the Arctic Circle we have a polar night. Then the day starts increasing in duration. At the equator, the day lasts for 12 hours, and a polar day sets in below the Antarctic Circle. As we approach the equinoctial points of 20.03, and 22.09, the difference between the days in latitude decreases in value. The day's duration along all latitudes becomes identical at 12 hours.

As the Earth moves along its orbit, the alteration of seasons occurs. The duration of the seasons is defined by the Earth's motion over certain orbital segments. From the vernal equinox day, 20.03, until the summer solstice day, 21.06, the duration of spring is 92.7 days. Over the *summer* segment, the duration is 93.7 days. Over the *autumnal* segment, the duration is 89.9 days. Over the *winter* segment, the duration is 89.0 days.

The Earth's orbital and rotational motions define the variation in climate in the current epoch. However, the motions vary in time, and the climate undergoes change. The position of Earth's orbit precesses in space. The Earth's orbital axis $\vec{S}$ (**Figure 1**), rotates, or in other words, it precesses about the direction of $\vec{M}$, which is motionless in space. The precession proceeds clockwise with a period of 68.7 thousand years. In a clockwise direction, the Earth's axis $\vec{N}$ precesses about the direction of $\vec{M}_2$, also motionless in space. The precession period is 25.74 thousand years. Besides this, the axes $\vec{S}$ and $\vec{N}$ execute oscillations, each with respect to its own precessional axis $\vec{M}$ and $\vec{M}_2$, respectively. In addition, the shape of the orbit (its eccentricity, whose value varies from 0 to 0.064; the current value being equal to 0.016) and the perihelion position, both undergo variations. Today, the perihelion is over the *winter* segment (**Figure 1**), when winter sets in the northern hemisphere. Since the Earth's orbital perihelion rotates in anticlockwise direction at a mean period of 147 thousand years, its position in other epochs can be at any point in the Earth's orbit.

The changes of the Earth's orbital and rotational motions lead to changes in its climate. Below, the latter changes are considered in more detail.

3.2. Evolution of the Earth's Orbital Motion

The evolution of the Earth's orbital motion is considered in a motionless frame, *xyz* whose origin is located at the center, *O* of celestial sphere 1 (**Figure 2**). Note that, depending on the particular problem of interest, the point *O* can be located either at the center of mass of the Solar system, at the center of the Sun, or at the center of the Earth. As a result of the interaction of Solar-system bodies, the Earth's equatorial plane 2 and its orbital plane 3 both alter their positions, which are denoted with digits 2 and 3 in the epoch T_0, and with digits 4 and 5 in the epoch *T*, respectively. At epoch T_0, we consider the epoch of the year 2000.0.

Since the annual motion of the Sun over celestial sphere 1 with respect to the Earth, proceeds along circles 5 or 3, the planes of the circles are additionally called, the planes of moving and motionless ecliptic, respectively. The frame *xyz* is related to the plane of the motionless Equator 2. The moving plane 5 of the Earth's orbit is defined by the angle $\varphi_\Omega = \gamma_0\gamma_2$ of the ascending-node position γ_2 and by the inclination of the plane *i*.

The Earth moves around the Sun along an open trajectory which is close to the shape of an ellipse. At one point in the trajectory, the perihelion, the Earth approaches the Sun to the shortest distance R_p, and at the opposite point, the aphelion, it moves away from the Sun to the largest distance R_a. In **Figure 2**, the projection of the perihelion onto the celestial sphere 1 is denoted with the character *B* and its position is coordinated with the angle $\varphi_p = \gamma_2 B$. The shape of the orbit is defined by its eccentricity $e = \left(R_a - R_p\right) / \left(R_a + R_p\right)$.

The oscillations of the angles φ_Ω and *I* reflect the rotation process of the orbit's axis $\vec{S}$ (**Figure 2**), that is, the normal to the orbit plane, with a period of 68.7 thousand years about the motionless vector $\vec{M}$ [20]. The latter vector is the sum of the angular momentum vectors of all bodies in the Solar system. The plane normal to $\vec{M}$ is called the Laplace plane. The angles that define the position of the Laplace plane with respect to the motionless equatorial plane *xOy* in radians are equal to i_M = 0.401834 and φ_M = 0.0680946. The rotation or, in other words, the precession of the axis $\vec{S}$ about the vector $\vec{M}$ proceeds

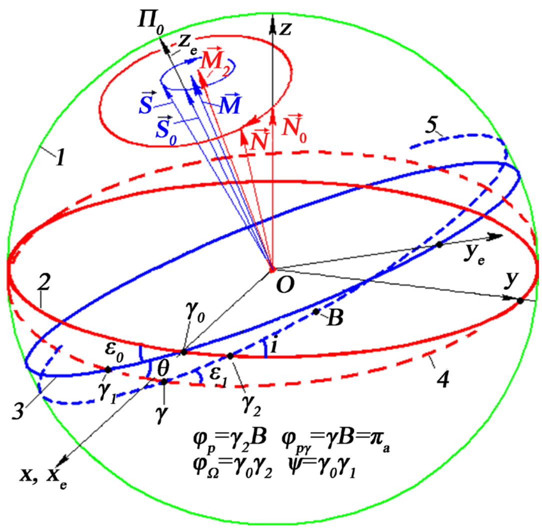

Figure 2. Parameters of the Earth's orbit and axis in the motionless equatorial *xyz* and motionless ecliptic $x_e y_e z_e$ coordinate systems. 1—the celestial sphere; the planes in the epoch of T_0: 2—that of the Earth's equator, 3—that of the Earth's orbit; in the epoch of *T*: 4—that of the Earth's equator, 5—that of the Earth's orbit; unit vectors: $\vec{N}$—Earth's axis, $\vec{S}$—Earth's orbit axis, $\vec{M}$—the angular momentum of the Solar system; γ_0—the vernal equinoctial point in the epoch of T_0; *B*—the perihelion's position on the celestial sphere; $\varphi_\Omega = \gamma_0\gamma_2$—the angle of the orbit's ascending node; $\varphi_p = \gamma_2 B$—the perihelion angle; *i*—the orbit's inclination.

in clockwise direction. In addition to the precession, the orbit's axis $\vec{S}$ executes oscillations at periods of 97.35 thousand years, 1.164 million years, and 2.32 million years, relative to the vector $\vec{M}$. During those oscillations, the angle between the vectors $\vec{S}$ and $\vec{M}$ never exceed a value of 2.94˚. All those motions are manifested in the behavior of angles φ_Ω and i in **Figure 3**.

Thus, the evolution of the Earth's orbit proceeds as a result of the following four motions: 1) precession of the orbit's axis $\vec{S}$; 2) oscillations of the orbit's axis $\vec{S}$; 3) oscillations of the orbit's eccentricity e; and 4) rotation of the orbit in its own plane (perihelion rotation).

Figure 3 shows the evolution of the Earth's orbital parameters e, φ_Ω, i and φ_p over a span of one million years. The shortest eccentricity oscillation period is T_{e1} = 94.5 thousand years, and the longer ones are the periods T_{e2} = 413 thousand years and T_{e3} = 2.31 million years [19, 20]. Both the angle, φ_Ω of the orbit's ascending node and the orbit's inclination, i oscillate with a period $T_\Omega = T_i$ = 68.7 thousand years. The increasing behavior of the angle, φ_p toward future (**Figure 3**) reflects the non-uniform rotation of the perihelion in anticlockwise direction with a mean period of T_p = 152 thousand years (over a time interval of one million years). As it is seen from the graph, there exists an epoch of a reverse, or clockwise, perihelion's motion.

3.3. Evolution of the Earth's Rotational Motion

Evolution of the Earth's rotational motion is treated in the motionless frame $x_e y_e z_e$ (**Figure 2**) connected

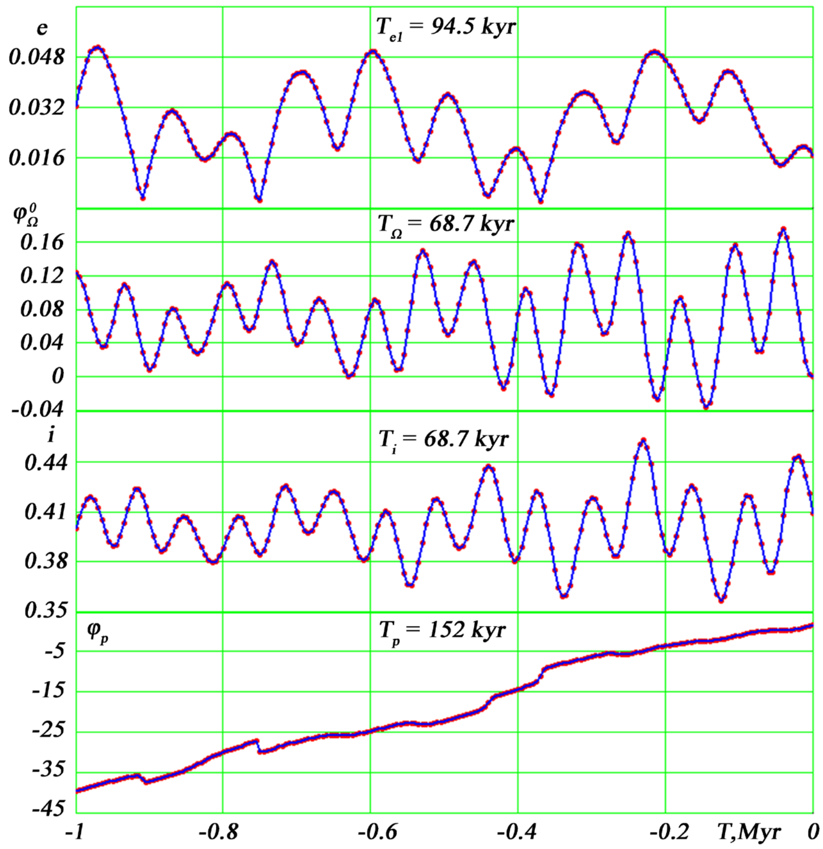

Figure 3. Evolution of Earth's orbital parameters over a time interval of 1 million years: e—eccentricity; φ_Ω—angle of the orbit's ascending node; i—orbit's inclination; φ_p—perihelion angle; T—time in million years reckoned from December 30, 1949; T_{e1}, T_Ω, and T_i—the least oscillation periods for the eccentricity, the ascending node, and the orbit inclination expressed in a thousand years; T_p—perihelion rotation period averaged over a time interval of 1 million years.

with the Earth orbit's motionless plane, 3. The inclination angle and the precession angle $\psi = \gamma_0\gamma_1$ both define the position of equator, 4 moving with respect to the orbit's motionless plane, 3. The precession angle ψ decreases toward future in an oscillatory manner at a mean rate of $\dot{\psi}_m = -2\cdot\pi/P_{pr}$ according to a linear law. Here P_{pr} = 25.738 thousand years is the period of the Earth axisial precession averaged over a time interval of 1 million years [7, 13, 14]. The negative sign of $\dot{\psi}_m$ implies that the unit vector $\vec{N}$ of the Earth's rotation axis precesses in a clockwise direction (**Figure 2**). Precession of the Earth's rotational axis, $\vec{N}$ proceeds around the second motionless vector $\vec{M}_2$; the angles defining the orientation of the plane normal to this vector with respect to the plane xOy are i_{M2} = 0.417728 and φ_{M2} = −0.0664662. The angle between the motionless vectors $\vec{M}_1$ and $\vec{M}_2$ is 3.201402˚.

The variation of the difference, $\Delta\psi = \psi - \psi_a$ for the precession angle, ψ (here, $\psi_a = \psi_0 + \dot{\psi}_m \cdot T$ is the change of the precession angle in the process proceeding at the mean rate $\dot{\psi}_m$) over a time interval of 1 million years, is shown in **Figure 4**. Over the latter time interval, the quantity, $\Delta\psi$ varies from −0.184 to 0.233 radian, so that the full oscillation swing amounts to 0.417 radian.

The inclination difference, $\Delta\theta = \theta - \theta_0$ in **Figure 4**, is given with respect to the initial angle θ_0 = 0.40904645. The quantity $\Delta\theta$ oscillates similar to, $\Delta\psi$, yet in a narrower range from −0.0845 to 0.0855, so that the oscillation range here amounts to 0.17 rad. Thus, the oscillation amplitude for angle θ is 2.45 times smaller than that for angle ψ. Besides, the oscillations of $\Delta\theta$ do not coincide in phase with the oscillations of $\Delta\psi$; they are shifted along the time axis T by −7.5 thousand years.

3.4. Evolution of the Earth's Orbital Motion Relative to Its Rotational Motion

The orbital-motion parameters i, φ_Ω and φ_p and the rotational-motion parameters ψ and θ are defined by the obliquity, ε and perihelion angle $\varphi_{p\gamma}$ of the orbit's moving plane 5 with respect to the moving equator 4 (**Figure 2**). The oscillation spectrum of $\varphi_{p\gamma}$ is rather broad since the angles φ_p, φ_Ω, i, ψ and θ contribute to the oscillations of this angle. The average variation of the angle, $\varphi_{p\gamma}$ proceeds according to the law $\varphi_{p\gamma m} = \varphi_p - (2\pi \cdot T/P_{pr})$.

Figure 5 shows the variation of ε over five different time intervals In [13]. Over short time intervals, the oscillations of θ and ε are roughly identical. Indicated in the graphs are the main oscillation periods T_{ni} and amplitudes (θ_{ai} and ε_{a4}) of the inclination angle: half-month period T_{n2} and half-year periods T_{n3} and T_{n4} = 18.6 years. Those oscillations are called nutation oscillations. The precession angle ψ exhibits similar oscillation periods, the amplitudes being two or three times greater.

Over the time interval In = 0.1 year, half-monthly oscillations are observed and diurnal oscillations with period T_{n1} = 0.9973 day can be traced; over the interval In = 1 year, half-year oscillations emerge; over the interval In = 10 years, an oscillatory trend with a T_{n4} = 18.6-year period is observed, with oscillations at this frequency prevailing over the time interval of In = 100 years.

Over the time interval In = 100 years, it is seen that the calculated obliquity ε 1) oscillates about its mean value, 2) received by S. Newcomb [16] and J. Simon *et al.* [17]. The oscillation amplitude ε_{a4} = 9.2" of the period, T_{n4} = 18.6 years also coincides with the observations. In astronomy, this quantity is called the nutation constant.

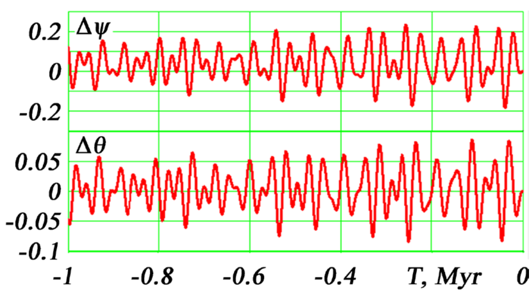

Figure 4. Evolution of the Earth's rotational motion over a time interval of 1 million years. The differences; the precession $\Delta\psi$ and inclination $\Delta\theta$ angles are given in radians.

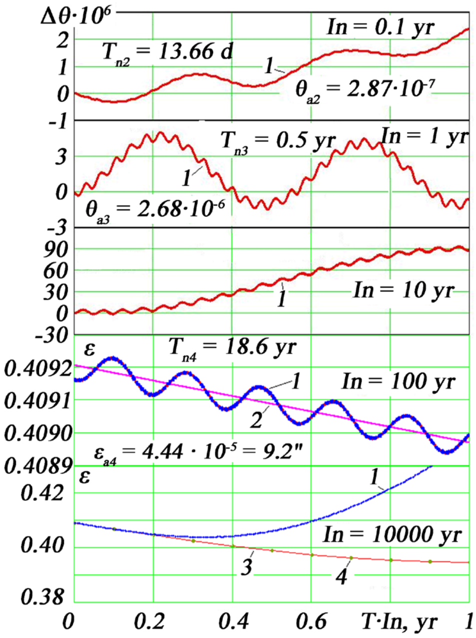

Figure 5. **The dynamic of the obliquity ε (in radians) over five time intervals *In*: *yr*—year; $\Delta\theta \approx \varepsilon - \varepsilon_0$; ε_0—the obliquity at the initial epoch of December 30, 1949. T_{n2}, T_{n3}, T_{n4} and θ_{a2}, θ_{a3}, ε_{a4}—the oscillation periods and amplitudes of the inclination angles; 1—according to the solutions of [7, 12, 13]; 2—approximation of observation data according to S. Newcomb [16] and J. Simon *et al.* [17]; 3—according to the solution by J. Laskar *et al.* [6]; 4—according to the solution by Sh. G. Sharaf and N. A. Budnikova [3].**

3.5. Evolution of the Earth's Obliquity and Insolation over a Span of 1 Million Years

As it is evident from **Figure 5**, over the time interval of *In* = 10 thousand years, a coincidence of the new obliquity ε 1 with the data 2 and 3 yielded by the first version of the Astronomical theory of climate change [1-6] is observed over a span of 2000 years.

It should be noted that these authors solved the problem in question over a large time interval: Sharaf and Budnikova [3] for 30 million years, and Laskar *et al.* [6] for an even longer period. We showed [18] that their results do not fundamentally differ from the results of Milankovitch [1], Berger and Loutre [4], Edvardsson *et al.* [5]. Therefore, we compare our results with these authors who are typical representatives of the former Astronomical theory.

As can be seen from **Figure 5**, after 2000 years, obliquity, ε calculated within the new version 1 of the theory shows clear deviation. As it is seen from the graphs of **Figure 6**, over the time interval of 1 million years the oscillations of ε as yielded by the second version of the theory proceed in the range of 14.7° to 32.1°, whereas the same range in the previous theory was from 22.08° to 24.45°; in other words, the range of oscillations in the second version of the theory proves to be seven times greater.

This difference is due to the fact that in the second version of Astronomical theory, the Earth's rotation problem was treated in full, without simplifications. The solution of this problem and various checks of obtained data were analyzed at length in the publications [7, 13, 21] and will be covered in the subsection 4.3.

The amount of solar radiation reaching the Earth's surface, also called the Earth's insolation, is defined by the parameters e, ε and $\varphi_{p\gamma}$. **Figure 6** gives a comparison of the insolation changes Q_s^{65N} occurring during the summer caloric half-year at the 65-deg northern latitude in the second version of the theory, (curve 1) [21] with the changes as calculated by the first version of the theory [6]. Here, the amplitude of insolation oscillations is also seven times greater than that in the previous theory. Besides, the insolation extremes occur at other times, and the oscillation periods are different. Note that the astronomical

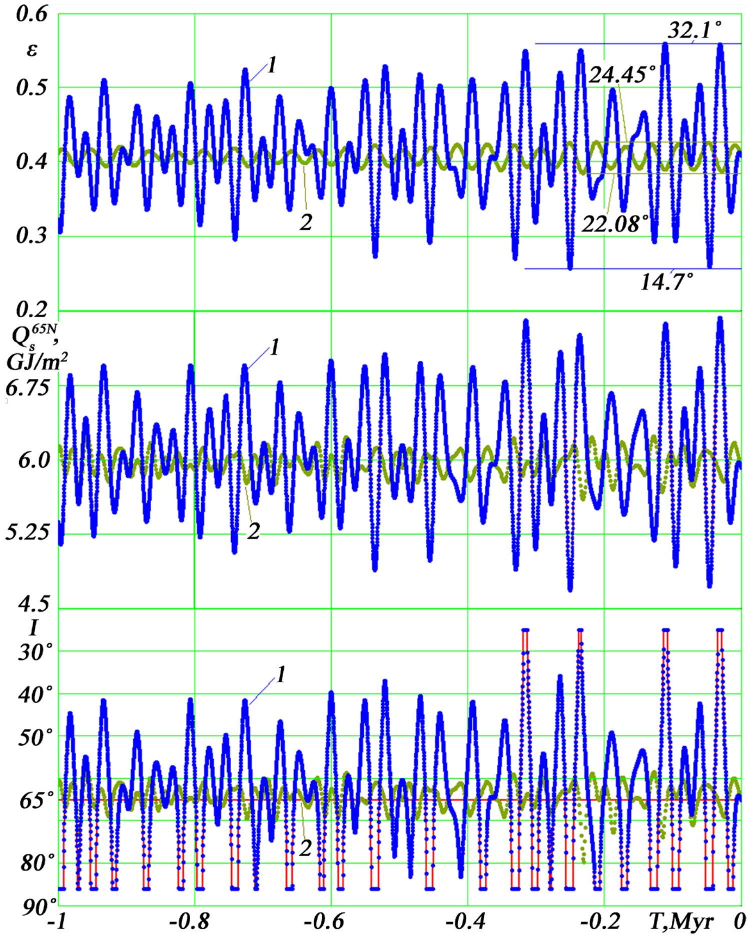

Figure 6. Evolution of the obliquity *ε* and that of summer half-year insolations Q_s^{65N} and *I* over a time interval of 1 million years. Comparison of results yielded by the second version of the Astronomical theory of climate change (curve 1), with the results of the first version of this theory (curve 2), demonstrated using, as an example, the work by J. Laskar *et al.* [6]. Q_s^{65N}—insolation in GJ/m² over the summer caloric half-year at 65-deg northern latitude; *I*—insolation at the equivalent latitudes over the summer caloric half-year at 65-deg northern latitude. Indicated in degrees are the maximum and minimum values of *ε*.

summer and winter half-years measured from the vernal equinox day to the autumnal equinox day and visa versa differ in duration for different epochs. That is why it is caloric half-year, equal in duration, that are considered here.

In order to compare climates in other epochs with the current climate, we consider the insolations at equivalent latitudes *I*. For calculating of *I*, we consider the Earth's latitude φ characterized by receiving same amount of summer solar radiation, Q_s as in the current epoch. Figure 6 shows the insolation oscillations at equivalent latitudes *I* over a time interval of 1 million years. The lowest values $I \approx 90^\circ$ indicate that at latitude $65^\circ N$ in summertime, there was less solar radiation on the pole than now. The highest values, such as $I \approx 23^\circ$ at the time −0.031 million years denote epochs in which, in summertime, the amount of solar radiation having reached the Earth at latitude $65^\circ N$ exceeds the amount of solar radiation having fallen onto it presently in the tropics, *i.e.* in the equatorial area. Such profound insolation oscillations lead to substantial climate oscillations. As it is seen from curve 2, the oscillations of *I* in the previous theory were less significant.

3.6. Variation of Insolation over the Earth's Latitude

Figure 7 shows the variation over the latitude φ of the year Q_T, and during caloric half-years summer Q_s, and winter Q_w insolations in three epochs: in contemporary epoch $T = 0$, in the warmest epoch $T = -31.28$ kyr and in the coldest epoch $T = -46.44$ kyr (over a time interval of 200 thousand years). Those epochs are characterized by the following values of 65˚*N* summer insolation: $Q_s^{65N} = 5.9$, 7.4, and 4.7 GJ/m^2, respectively. In those epochs, the obliquities were $\varepsilon = 23.44˚$, 32.10˚ and 14.8˚, respectively.

The summer insolation Q_s (**Figure 7**, dashed lines) in contemporary epoch, 1 exhibits a minimum value on the poles, and it reaches a maximum value at the tropics $\varphi = \varepsilon$, and in the vicinity of the equator, this insolation exhibits a minimum. As we move from the cold (line 3) to the warm epoch 2, the summer insolation Q_s on the poles increases by a factor of 2.07. At latitude 65˚*N* this insolation increases by a factor of 1.57. Since, on the average, this latitude well represents the variation of insolation at high latitudes, the above insolation was adopted by Milankovitch [1] as reference one in the climate characterization procedure. In warm epoch 2, the summer insolation Q_s has an equatorial minimum in the southern hemisphere, and in cold epoch 3, in the northern hemisphere.

The winter insolation Q_w (**Figure 7**) on the poles is zero, and it monotonically increases in the equatorial region. In the equatorial region, the insolation Q_w exhibits a maximum at a latitude, φ at which the summer insolation Q_s shows a minimum. Over the period from cold epoch 3 to warm epoch 2, the winter insolation Q_w exhibits most pronounced variations at middle latitudes. In the latter situation, for epochs 2 and 3 under consideration, e.g. at the latitude $\varphi = 40˚$, the change of the winter insolation is 1.38 times greater in the northern hemisphere than in the southern hemisphere. In cold epoch 3, the winter insolation at all latitudes is greater than that in warm epoch 2. In other words, during the cold epochs the winter seasons are warmer than those during the warm epochs.

The annular insolation Q_T (**Figure 7**) monotonically increases from the poles toward the equator. At the equator, the annular insolation exhibits a maximum, with the annular insolation being symmetrical with respect to the equator. In other words, the amounts of heat per year are identical in both hemispheres. From cold epoch 3, to warm epoch 2, the annular insolation Q_T on the poles increases by the same factor as the summer insolation Q_s. With decreasing latitude, the difference between the annular insolations decreases,

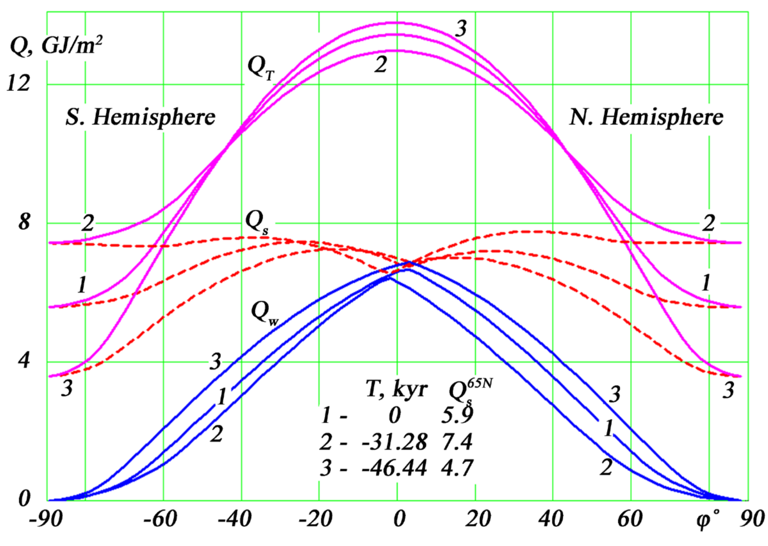

Figure 7. The distribution over latitude φ of insolations over three epochs. (Q_s, is summer half-year insolation; Q_w is winter half-year insolation; Q_T, is annular insolations; 1 is contemporary epoch; 2 is the warmest epoch and 3 is the coldest epoch over a time interval of 200 thousand years; Q_s^{65N} is insolation in GJ/m^2 over the summer caloric half-year at 65-deg northern latitude; *T*, kyr—time in thousand years).

and at the latitude, $\varphi = 45^\circ$ the annular insolation experiences no changes. In the equatorial region, the changes of Q_T are reciprocal to its changes at the high latitudes: in cold epoch 3, the amount of heat per year exceed that in the warm epoch. In the latter situation, the change of insolation Q_T is four times smaller than that in the high-latitude region. That is why the main changes of the annular insolation occur at high latitudes.

3.7. Periods and Gradations of Earth's Climate Changes

Over the previous interval of 200 thousand years (see **Figure 8**), 13 climatic periods O_I, 1_I, 2_I, 12_I were identified [19, 22]. As a result of the comparison of these periods with paleoclimate data for Western Siberia over 50 thousand years, it was found that the periods 3_I, 2_I, 1_I, O_I refer respectively to the Ermakov ice age, Karginsky warming, Sartan glaciation, and Holocene optimum. Those events also correspond to ice ages and interglacial periods in Europe and North America.

Also, the following gradations of the warm and cold climate were introduced (**Figure 8**): moderately warm, warm, and extremely warm climate levels, and moderately cold, cold, and extremely cold climate levels. During the past period of 1 million years (see **Figure 9**), the Earth has experienced six extremely cold (e.c.) periods and four extremely warm (e.w.) periods. The total number of cold (c.) and warm (w.) periods was 16 warm periods and 16 cold periods. Other periods were moderately cold (m.c.) ones and

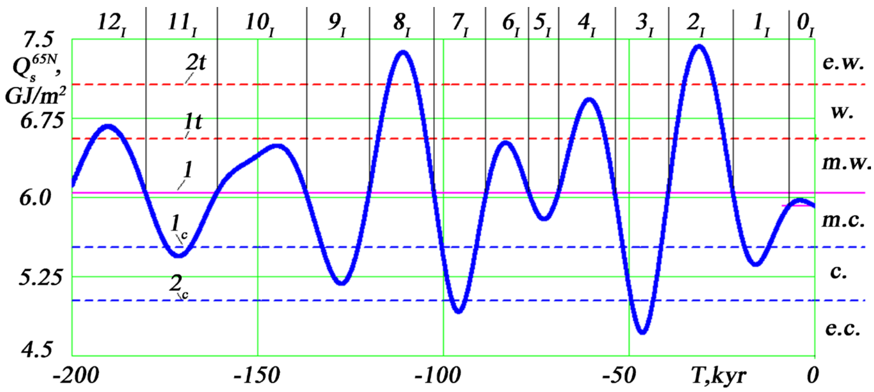

Figure 8. **Insolation periods O_I, 1_I, 2_I, … 12_I over a time interval of 200 thousand years and their boundaries: 1—mean insolation Q_{sm}; $1t$ and $2t$—the first or second boundaries of warm levels; $1c$ and $2c$—the first and second boundaries of cold levels; m.w., w., e.w—moderately warm, warm, and extremely warm levels; m.c., c., e.c. —moderately cold, cold, and extremely cold levels.**

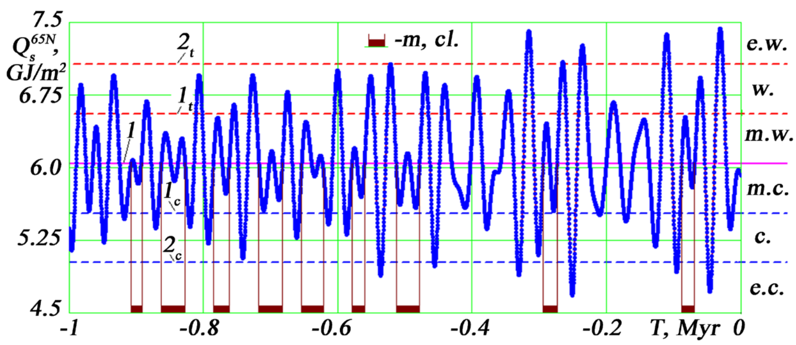

Figure 9. **Climate levels over a time interval of 1 million years: 1—mean insolation Q_{sm}; $1t$ and $2t$—the first and second boundaries of the warm levels; $1c$ and $2c$—the first and second boundaries of the cold levels; m.w., w., e.w.—warm climate levels; m.c., c., e.c.—cold climate levels. m. cl.—moderate-climate periods.**

moderately warm (m.w.) ones. Besides, there were nine moderate-climate (m.cl.) periods, which included both cooling and warming phases.

4. DISCUSSION

4.1. Statements of the Problems and the Differences among Them

In the previous Astronomical theory of climate change, variations of Earth's orbital elements were received on the basis of the theory of secular perturbations. This is an approximate analytical method for solving the interaction problem for Solar-system bodies. In that theory, the changes of the equator plane 4 (**Figure 2**) were analyzed approximately. With respect to this plane, the angle ε of the inclination of the orbital plane 5 and the perihelion position (being, in our notation, the angle $\varphi_{p\gamma}$ in **Figure 2**) were determined.

In the new Astronomical theory the interaction problem for Solar-system bodies (for simplicity, we will call this the orbital problem) was solved, using no simplifications, with a high-precision numerical method using a specially developed Galactica system [9-11]. In the latter case, we consider a change in the orbital plane (item 5 in **Figure 2**) relative to the fixed space represented by the equatorial plane 2 on a certain epoch. Here, the inclination, i of the orbital plane 5 and the ascending-node angle φ_Ω differ from the angles figuring in the theory of secular perturbations. As it was noted above, in this theory the angle ε between the moving equatorial plane 4 and the moving orbital plane 5 was used.

Unlike in the theory of secular perturbations, we also numerically solved a second problem; the one about the Earth's rotation, governed by its own differential equations. As a result, we obtain the laws of variation of the inclination angle θ and the precession angle ψ of the moving equatorial plane 4 with respect to the motionless orbital plane 3 (**Figure 2**).

A third complex geometric problem was then solved analytically for determining both the obliquity ε of the moving equatorial plane 4 with respect to the moving orbital plane 5 and the perihelion angle $\varphi_{p\gamma}$. The solution of the problem over short time intervals of the order of one thousand years is available in celestial mechanics. Over time intervals of several million years, during which those two planes and the orbit perihelion executed many irregular rotations in both directions, no solution was known.

A fourth problem, which yields the variation of the insolation versus the change of Earth's orbital and its axis parameters, thus offering an insolation theory, was presented in its complete form by M. Milankovitch in the first quarter of the twentieth century. We have also solved this problem in a new way [15]. Here, a new mathematical algorithm for elliptic motion, more understandable to non-specialists and useful for computer calculations, was employed.

All equations, including the differential equations for the orbital and rotational motions, were derived using a novel approach. Since the resulting data were other quantities in different representations, new methods for their analysis were developed. All that activity was accompanied with the development of computer codes written in various programming languages.

4.2. Adequacy of the Solution of the Orbital Problem

In connection with the new solutions of all four problems, at due stages, all the problems were subjected to checking. For checking the adequacy in the solution of the orbital problem, nine trustworthiness criteria were developed. Some of those criteria were included into the Galactica program; that is why control was exercised right in the course of solving the problem. For all bodies having an observation base (these are the planets from Mercury to Neptune, and also the Moon, the solutions over the time interval of several thousand years were compared with the secular variations of orbital parameters. The coincidence was found to be excellent [20, 23].

Over intervals of hundred thousand and million years, the orbital parameters were compared to the results obtained by the previous researchers [3, 4, 6]. The data were also found to be coincidental. Each of subsequent authors took into account the experience gained by previous researchers and made the theory of secular perturbations more refined. The theory was confirmed by making necessary comparisons. The later the works were published, the longer was the time interval over which the corresponding results were coincident with our data [20].

As it was noted previously, the perturbation theory is an approximate method for solving the orbital problem. After 20 million years, the solution obviously started departing from the actual data: the orbits of individual planets started increasing in size and, later, the planets could leave the Solar system [24]. We have solved the orbital problem over a time interval of 100 million years. All the orbital parameters of the planets and Moon executed steady oscillations, and there existed no tendency toward the change of those oscillations [20].

4.3. Adequacy of the Solution of the Earth's Rotation Problem

Points concerning the reliability of the solution of the Earth's rotation problem were analyzed in detail in publications [7, 13, 14]. Within the adopted solution method, all necessary checks were performed. For instance, the problem was solved in succession, implying the action of one of ten bodies (the Sun, the eight planets, and the Moon) [12]. The obtained oscillation periods of the Earth's axis were confirmed with general conclusions made on the basis of the theorem of change in angular momentum and also, with the results of other authors [25]. With the actions due to all bodies, the problem was solved over different time intervals; as it was shown previously in sec. 4 and sec. 5, the obtained data proved to be coincident with observations. Integration of the equations over a time interval of 200 thousand years was performed with different initial conditions and integration steps. The latter resulted in no changes of the oscillation periods, oscillation amplitudes, and the onset times of the extremes.

From the graph with the interval I_n = 100 yr in **Figure 5**, one can see that the middle of the oscillations of the calculated 1 obliquity ε coincides with the observed average angle 2. That average angle 2 complied with all ancient observations made over a period of 2.5 thousand years of their history. The obtained oscillations with 9.2" amplitude and 18.6-year period were found to be precisely coincident with the observed oscillations. In the graph of **Figure 5**, with the interval I_n = 10,000 yr., it is seen that the deviation of the calculated angle, ε from the linear trend established for observational data, starts manifesting itself after 2.5 thousand years. In **Figure 5**, solutions for future time intervals are shown. The solutions for previous time intervals have a similar general appearance.

Following 2.5 thousand years, solutions obtained by previous researchers also started departing from the linear trend. From this time on, differences between solutions 2 and 3 by those authors and our solution 1 was observed. Over a longer time interval, namely, 200 thousand years, the Earth's rotation problem was solved initially towards the future [26]. The solution for, ε was found to feature a different oscillation structure and other onset times for extremes, and what was most important, the amplitude of new oscillations exceeding the amplitude of the previous oscillations by a factor of 7 - 8 was revealed. From this time on, a solution check for the Earth's rotation problem was initiated. This check lasted for three years.

The Earth's rotation problem is one of the most complex problems in mechanics. Its solution can depend on the fundamental assumptions made while deriving the equations, on the choice of initial conditions, and on the procedure of solution reduction to the Earth's moving orbit. That is why a cardinal check of obtained results would be their obtaining, without solving differential equations for rotational motion.

While studying the orbits of the bodies, we found that the evolution of the Moon's orbital axis was similar to that of Earth's axis of rotation. That result had led us to a compound model for Earth rotation in which, part of the Earth's mass was uniformly distributed among peripheral bodies rotating around a central body, along a circular orbit. Under the action of the Moon, the Sun, and the planets, the orbits of the peripheral bodies started changing. It should be noted that under the axis of the orbit is meant a perpendicular to its plane. The evolution of the orbital axis of one of the bodies, modeled the evolution of the Earth's axis. Such modeling of the Earth's rotational motion included performing several solution stages of the orbital problem being treated with the Galactica program. In the initial series of our studies [20, 27], three models were studied, and the possibility of modeling the evolution of the Earth's axis was confirmed. In those models, the precession periods of the orbit axes were 170 and 2604 years, whereas the average period of the Earth's precession axis is known to be 25,740 years. Was subsequently yet developed 11 models, while has not been reached the required period of precession [7, 13]. In the 13th model, the orbital radius of the peripheral bodies was equal to the Earth's radius, the rotation period of the bodies was 0.142 hour, and the interaction between the model's bodies was amplified by a factor of 9.6 in comparison with the gravitational interaction. Thus, the bodies of the 13th model rotated 170 times faster than the Earth does. For studying the evolution of such models, the Galactica program was developed; in this model, the possibility of changing the interaction between the model's bodies was provided.

The solution of the problem for the 13th compound model of the Earth, over a time interval of 300 years [7, 13], has yielded all characteristics of the dynamics of the Earth's axis, including the half-monthly and half-year oscillations of the angles ε and ψ and the oscillations of those angles with a 18.6-year period. The amplitudes of those oscillations have also proved to be coincident with the solution results of the Earth's rotation problem. Such a coincidence in the results of the model problem with the results of the direct problem occurs once over a period of 3 thousand years. Further solution of the problem is hampered by the necessity to reduce the integration step to values for which the computing time turns out to be too long. Thus, over a time interval of 3000 years the compound model of the Earth has confirmed the obtained results of integration of the differential equation for Earth's rotation. The latter indicates that the assumptions and simplifications adopted in the derivation of the equations, the derivation of the equations itself, the solution method, and the transforming of the integrated data into the final form have also been confirmed.

A second check consisted in using an alternative integration method. In the program DfEqAl1.for solving the Earth's rotation problem, a fourth-order Runge-Kutta integration method as implemented by Krut'ko *et al.* [28] was used. Over a time interval of 200 thousand years, a growth of daily oscillations of the derivatives $\dot{\psi}$ and $\dot{\theta}$ was identified. Next, a code for solving the DfEqADP8.for program was developed, which uses the Dormand-Prince method, *i.e.* the eight-order Runge-Kutta integration method [29]. In integrating the equations of rotational motion over a period of 200 thousand years all previously obtained results have found confirmation. In the latter case, the amplitude of the daily oscillations of $\dot{\psi}$ and $\dot{\theta}$ showed no increase and remained at one and the same level. Thus, the particular method for integrating the equations does not affect the obtained results, and the application of a more accurate method confirms them.

A third check consisted in employing another method for solving the problem. The differential equations for rotational motion contained the coordinates of ten bodies acting on the Earth (eight planets, the Sun, and the Moon). Those coordinates were determined while solving the orbital problem with the Galactica program. However, the data array over large time intervals obtained with an integration step equal to 10^{-5} - 10^{-4} years took an overly large memory space. That is why we have developed a mathematical model for the Solar system [30] that yielded the coordinates of the bodies at a desired time, calculated by the formulas for elliptic motion in which the ellipse parameters at each time, were determined from the data initially calculated by the Galactica program. In the course of the solution process of the problem, the mathematical model for the Solar system was subjected to a thorough check. Nonetheless, there still existed a probability that, over large time intervals, the insignificant differences between the results of the mathematical model for the Solar system and the coordinate values obtained by the Galactica problem, could affect the evolution of the rotational parameters ε and ψ. We have developed a new program, glc3rte2.for, for joint solution of the orbital problem and the Earth's rotation problem. In the latter program, in one step over time, the Galactica program solved the orbital problem and, then, the Dormand-Prince method was used to solve, in the same step, the Earth's rotation problem. With the help of the new program, we have obtained solutions of those problems over different time intervals, including the interval of 200 thousand years. All previously obtained results have found confirmation. The latter check also confirms the mathematical model for the Solar system over large time intervals.

Table 1 gives a quantitative comparison of precession periods P_{prN}, and the minimum and maximum obliquities (ε_{min} and ε_{max}, respectively), accurate to five significant digits. Within this accuracy level, the first two methods have yielded identical results. As it is evident from **Table 1**, the data calculated by the

Table 1. **Comparison of results obtained by three methods for integration of rotational-motion equations over a period of 200 thousand years: RK-4—Runge-Kutta method of the fourth order; DP-8—Runge-Kutta method of the eighth order in Dormand-Prince realization; Gal—the bodies' coordinates are determined by the Galactica program, and the rotational-motion equations are solved by the DP-8 method.**

Method	P_{prN}, year	ε_{min}	ε_{max}
RK-4	−25774	14.806˚	32.073˚
DP-8	−25774	14.806˚	32.073˚
Gal	−25749	14.802˚	32.077˚

third method, differed in terms of precession period P_{prN} in the fourth digit, and in terms of ε in the fifth digit. Since the latter method was a most accurate one, the latter values provided refined results in comparison with the data obtained by the first two methods.

Thus, the various tests and verification of the initial solution method of the Earth's rotation problem and also, independent solutions of the same problem by three other methods, have confirmed the fact that the Earth's rotational axis executes oscillations at an amplitude of 7 - 8 times greater than that obtained in the previous solutions.

4.4. Adequacy of the Solution of the Third and Forth Problems

As it was noted previously, the third problem on the determination of the obliquity ε between the moving equatorial plane 4 and the moving orbital plane 5, and the perihelion angle $\varphi_{p\gamma}$ (Figure 2), was a geometrically complex problem because a multitude of revolutions on the axes $\vec{N}$ and $\vec{S}$, and the perihelion B, were executing about different axes in different directions. For instance, the Earth axis, $\vec{N}$ executed 777 revolutions per 20 million years of problem solution. In the problem, it was required to determine, from the obtained solution of the orbital problem for i, φ_Ω, and φ_p (Figure 2) and the Earth's rotation problem for θ and ψ, the relative-motion characteristics, ε and $\varphi_{p\gamma}$.

Those transformations were derived; yet, they involved inverse trigonometric functions, known to be many-valued. The expressions themselves are cumbersome, with some their parts presenting imaginary or infinitely growing expressions. Those singularities needed to be identified for the revealing factors underlying their behavior and for developing algorithms for elimination of these factors. Initially, this problem was solved by means of spherical geometry. However, because of the complexity of involved logical concepts, there was no firm belief in adequacy of the obtained solution. Fortunately, an idea suggesting a second method had emerged. The axial vectors, $\vec{N}$ and $\vec{S}$ were replaced with their projections onto the axes of a Cartesian coordinate system. Then, trigonometric means were employed to derive the required transformations. The two transformation systems have allowed us to reveal errors in each of the systems and fix them, unless both systems started yielding the same results in the examined 20-million-year time interval.

The new algorithm developed for calculating the insolation in the fourth problem was checked [19] by performing insolation calculations using the orbital data by Milankovitch [1], J. Laskar *et al.* [6]. The new algorithm has yielded results, the same as those yielded by the Milankovitch algorithm.

4.5. Physical Cause of the Difference between the New and Previous Theory

As it was noted previously, according to the new solutions for the angles θ and ψ, the Earth's rotation axis $\vec{N}$ rotates around the vector $\vec{M}_2$ (Figure 2), and it additionally exerts oscillations about that vector. We have calculated the angle θ_{M2} between the vector $\vec{M}_2$ and the axis $\vec{N}$ and also, the angle ψ_{M2} of the equator-plane precession, with respect to the plane normal to $\vec{M}_2$. The main oscillation period of the angles θ_{M2} and ψ_{M2} proved to be equal to 41.1 thousand years. As was noted previously, the Earth's orbital axis $\vec{S}$ precesses in a clockwise direction around the vector $\vec{M}$ at a period P_{prS} = −68.7 kyr, and the Earth's axis $\vec{N}$ rotates around the vector $\vec{M}_2$ as well, at a period P_{prN} = −25.74 kyr. Since both axes precess in one direction, the effect of the orbital motion on the rotational motion will depend on the relative precession velocity. The period of that action P_{rl}, is defined by the reciprocal ratio of angular velocities $P_{rl} = \frac{P_{prS} \cdot P_{prN}}{P_{prS} - P_{prN}}$. After substitution of actual values, we have obtained a value P_{rl} = −41.1 kyr, that is, the very oscillation period of the angles θ_{M2} and ψ_{M2}. In the previous Astronomical theory of climate change, the main oscillation period of the obliquity, ε was equal to 41 thousand years. As was noted previously, that theory was based on a simplified solution of the Earth's rotation problem. The obtained simplified solution has resulted in identical positions of the vectors $\vec{M}_2$ and $\vec{M}$ (**Figure 2**) and finally, in the obtained period of 41 thousand years.

In the new theory (**Figure 2**), the vectors $\vec{M}_2$ and $\vec{M}$ of the precessional axes have different orientations. That is why the moments of forces by which all bodies act on the Earth exhibit a wide range of oscillations. As a result, the oscillation range of θ with respect to the motionless orbit, (3) also increases. In addition, the oscillation range of the angle, ε between the moving orbital axis $\vec{S}$ and the moving axis $\vec{N}$ increases as well. All in all, in the new theory, the oscillation amplitude of angle, ε turns out to be exceeding the same amplitude in the previous theory by a factor of 7 - 8.

Thus, the oscillation period of obliquity ε in the previous theory of Earth-axis dynamics, was the period P_{rl} of the relative precession of Earth's rotational axis $\vec{N}$ and its orbit $\vec{S}$. That is why it is a fact that the precessional axes $\vec{M}$ and $\vec{M}_2$ of the orbital axis $\vec{S}$ and the Earth axis $\vec{N}$ were assumed coincident, was the physical cause behind obtaining erroneous results in the previous theory.

4.6. Final Verification

The final check of the Astronomical theory of climate change consisted in the comparison of its results with paleoclimate. While analyzing data gained by geologists, geographers, and other specialists in the field of paleoclimate, we have found [22, 31, 32] four extremes of summer insolation Q_s^{65N} having occurred over the past 50 thousand years; namely, 4.16, 15.88, 31.28, and 46.44 thousand years ago; those dates correspond to the middle of Holocene, to the middle of the last ice age, to the middle of a warm period, and to the middle of the penultimate ice maximum, respectively. Those events are called differently in different regions of the world; yet, all of them have left their traces in Siberia, Europe, and Northern America.

The whole complex of performed studies and their tests outlined here give us grounds to assert that, in the present article, results of Astronomical theory of climate change obtained by taking into account all studies performed during past centuries, are reported.

Changes of obliquity, ε and angle of the perihelion, $\varphi_{p\gamma}$, as well as the eccentricity of the orbit, e are available at http://www.ikz.ru/~smulski//Data/Insol/ in the file OrAl1c_8.prn for ±100 years, in the file OrAl-5kyr.prn for 5 thousand years ago (ka), in the file OrAl-200ky.prn for 200 ka, in the file OrAl0-5My.prn for 5 Ma. The program, Ins12bdEn.mcd for analyzing these data, calculating the insolation of the Earth and the building of graphs is available on this site.

5. CONCLUSION AND FURTHER DEVELOPMENT OF THE ASTRONOMICAL THEORY OF CLIMATE CHANGE

As a result of the interaction of Solar-system bodies, evolution of the Earth's orbital and rotational motions proceeds; this evolution in turn gives rise to insolation oscillations being the cause of climate changes observed over time intervals of tens of thousands of years. The same interactions lead to the evolution of the Sun's motion about the center of mass of the Solar system [20, 33] and also, to a change in the rotational motion of the Sun. Studies show [34], that the change in motions presents the cause of variations in solar activity. The radiation fluxes due to the Sun and its substance act on the Earth's upper shells, thus leading to circulation changes arising in its atmosphere and ocean. Very likely, these factors act as the cause of short-term climate variations occurring over periods of several ten and hundred years. Further development of the Astronomical theory of climate change will be related to the determination of those oscillations.

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CONFLICTS OF INTEREST

The author declares no conflicts of interest regarding the publication of this paper.

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32. Smulsky, J.J. (2019) The Upcoming Tasks of Fundamental Science. Sputnik + Publishing House, Moscow, 134 p. (In Russian) http://www.ikz.ru/~smulski/Papers/InfPrZaFN.pdf
33. Smulsky, J.J. (2017) Cosmic Impacts on the Earth and Their Influence on the Arctic. *The Complex Systems*, **4**, 27-42. (In Russian) http://www.ikz.ru/~smulski/Papers/CsmAcEIA.pdf
34. Mörner, N.-A. (2016) Planetary Influence on the Sun and the Earth, and a Modern Book-Burning. Nova Science Publishers, New York, 196 p.

Discussion

1. Earth-Science Reviews

September 04, 2018

Author's Cover Letter

Dear EARTH-SCIENCE REVIEWS,

Via your submission system I submit my article: Smulsky J.J. New Long-Term Climate Oscillations.

Sincerely yours 04.09.2018 Prof. Joseph J. Smulsky

Earth-Science Reviews

From: Tim Horscroft EviseSupport@elsevier.com
To: jsmulsky@mail.ru
Sent: Tuesday, September 04, 2018 4:46 PM
Subject: Article transfer offer - NEW LONG-TERM CLIMATE OSCILLATIONS
Ref: EARTH_2018_445
Title: NEW LONG-TERM CLIMATE OSCILLATIONS
Journal: Earth-Science Reviews

Dear Professor Smulsky,

Thank you for your ms. This is alas not a review, and there are far better journals, such as those dealing with planetary dynamics etc, for work such as this,

With our best wishes for finding a good venue, which given your ms will not be difficult.

Tim Horscroft
Managing Editor

==============

Form mail:

Thank you for your submission to Earth-Science Reviews. Having now evaluated your manuscript, I feel there are other Elsevier journals that may better suit the scope.

Please click on the link below to find out more about the alternative journals I recommend. They all participate in Elsevier's Article Transfer Service, which means you do not have to resubmit or reformat your manuscript, you just have to accept or decline the transfer offers. The link is valid for 30 days.

http://www.evise.com/evise/faces/pages/mslanding/AtsLanding.jspx?jid=MTk2Nw==&sub=Mzc3ODg5Nw==&sm=bWFpbA==

The Article Transfer Service aims to speed up the publication of promising papers. To help with that process, any editor and reviewer comments are transferred with your manuscript - if they are available for your submission, you will find them listed below my signature at the end of this letter. Please note that your acceptance of a transfer offer does not guarantee that your paper will be published in the journal you have selected.

To learn more about the Article Transfer Service, please visit www.elsevier.com/authors/article-transfer-service

Kind regards,
Tim Horscroft
Review Paper Coordinator
Earth-Science Reviews

Have questions or need assistance?

For further assistance, please visit our Customer Support site. Here you can search for solutions on a range of topics, find answers to frequently asked questions, and learn more about EVISER via interactive tutorials. You can also talk 24/5 to our customer support team by phone and 24/7 by live chat and email.

Author's reply

No Comments.

Author's Comment

In subsequent journals, I sent this paper with a changed title "MAIN ACHIEVEMENTS OF THE NEW ASTRONOMICAL THEORY OF CLIMATE CHANGE".

2. Quaternary Science Reviews

January 29, 2019

From: "Scientific Reports"
From: Claude Hillaire-Marcel (Quaternary Science Reviews)
Sent: Tuesday, January 29, 2019 10:46 AM
Subject: Your manuscript, JQSR_2018_602, has not been accepted
Ref: JQSR_2018_602
Title: MAIN ACHIEVEMENTS OF THE NEW ASTRONOMICAL THEORY OF CLIMATE CHANGE
Journal: Quaternary Science Reviews

Dear Professor Smulsky,

I do apologize for the delay in handling the above submission. All reviewers contacted but one declined the invitation to review the paper. The only comment we received so far about the work (see below) highlights a non transient error in the study. I regret to inform you that cannot therefore accept it for publication.

Kind regards,

Claude Hillaire-Marcel
Editorial team
Quaternary Science Reviews

Comments from Reviewer 1:

- The coordinate system of precession and obliquity is rotating, because the plane of the Earth's orbit is not fixed in space, so the differential equations of obliquity determination are seriously wrong and the results and interpretation of insolation variations are not correct.

Have questions or need assistance?
For further assistance, please visit our Customer Support site. Here you can search for solutions on a range of topics, find answers to frequently asked questions, and learn more about EVISER via interactive tutorials. You can also talk 24/5 to our customer support team by phone and 24/7 by live chat and email.

From: Joseph J. Smulsky
To: hillaire-marcel.claude@uqam.ca
Sent: Friday, February 01, 2019 6:20 PM
Subject: Re: Your manuscript, JQSR_2018_602, has not been accepted

Author's reply

From: Joseph J. Smulsky
To: hillaire-marcel.claude@uqam.ca
Sent: Friday, February 01, 2019 6:20 PM
Subject: Re: Your manuscript, JQSR_2018_602, has not been accepted

Dear Claude Hillaire-Marcel,
Editorial team,
Quaternary Science Reviews,

1. Reviewer's comments refer to differential equations and coordinate system. Since they are not considered in my paper, these comments do not apply to it.
2. If these comments are intended for my paper, then they are meaningless. In this case, the reviewer deliberately lies to reject the paper.
3. My paper presents the results of the New Astronomical Theory of Climate Change. It gives such periods of cooling and warming, which coincide with the same changes in the paleoclimate.

The previous Astronomical theory of climate change did not coincide with the paleoclimate and contradicted it. Therefore, its supporters are now in shock.

You sent me three letters: on September 7, November 29 and December 30, in which you wrote that reviewers refuse to review the paper. Refusing is not the worst thing to do. This reviewer committed a crime; he deliberately gave a false review.

4. Your decision founded on false review is also false and criminal.
5. In this situation, there is a way out. It is necessary to publish the paper with the reviewer's comments and my answer to them. Only in this case the name of the reviewer should be open.
6. The new Astronomical Theory of Climate Change will inevitably enter life, and the whole history of the Earth will be based on it. If your journal does not publish the paper, it will only delay its use in the English-speaking world for several years. And your journal and you, as Member of Quaternary Science Reviews' Editorial team, will go down in the history of science, like those that hindered its development.

Sincerely yours February 01, 2019 Prof. Joseph J. Smulsky

3. Palaeogeography, Palaeoclimatology, Palaeoecology

April 12, 2019

From: Thomas Algeo (Palaeogeography, Palaeoclimatology, Palaeoecology)
To: jsmulsky@mail.ru
Sent: Friday, April 12, 2019 8:00 PM
Subject: Your manuscript, PALAEO_2019_291, has not been accepted

Ref: PALAEO_2019_291
Title: MAIN ACHIEVEMENTS OF THE NEW ASTRONOMICAL THEORY OF CLIMATE CHANGE
Journal: Palaeogeography, Palaeoclimatology, Palaeoecology

Dear Professor Smulsky,

Thank you for submitting your manuscript to Palaeogeography, Palaeoclimatology, Palaeoecology.

Palaeo-3 now receives between 900 and 1000 manuscripts each year. As a consequence, the journal has implemented a new policy of pre-screening in which a substantial fraction (~40-50 %) of incoming manuscripts are declined without review. As the receiving editor, I make judgments about the thematic appropriateness, quality, and novelty of each study submitted. I regret that your manuscript did not meet the threshold for review. I wish you success in finding an appropriate publication outlet for your study.

This study belongs in an astronomy/astrophysics journal, not PPP.

We appreciate your submitting your manuscript to this journal and for giving us the opportunity to consider your work.

Kind regards,
Thomas Algeo
Editor-in-Chief
Palaeogeography, Palaeoclimatology, Palaeoecology

Comments from the editors and reviewers:
Have questions or need assistance?
For further assistance, please visit our Customer Support site. Here you can search for solutions on a range of topics, find answers to frequently asked questions, and learn more about EVISER via interactive tutorials. You can also talk 24/5 to our customer support team by phone and 24/7 by live chat and email.

Author's reply

No Comments.

4. Global and Planetary Change

May 22, 2019

From: Alan Haywood (Global and Planetary Change)
To: jsmulsky@mail.ru
Sent: Wednesday, May 22, 2019 9:02 PM
Subject: Your manuscript, GLOPLACHA_2019_237, has been withdrawn
Ref: GLOPLACHA_2019_237
Title: MAIN ACHIEVEMENTS OF THE NEW ASTRONOMICAL THEORY OF CLIMATE CHANGE
Journal: Global and Planetary Change

Dear Professor Smulsky,

We would like to inform you that your manuscript referenced above has been withdrawn from Global and Planetary Change and is no longer under consideration for publication. The scientific remit of GPC has recently been changed and this revised remit is available to view on the GPC website. After carefully examining your interesting work I must regrettably conclude the that subject matter does not really provide an adequate fit to the new remit of the journal. I would recommend submission to a more specialized journal such as A&A for example.
Thank you for submitting your work to Global and Planetary Change.
Kind regards,
Alan Haywood
Global and Planetary Change
Have questions or need assistance?
For further assistance, please visit our Customer Support site. Here you can search for solutions on a range of topics, find answers to frequently asked questions, and learn more about EVISER via interactive tutorials. You can also talk 24/5 to our customer support team by phone and 24/7 by live chat and email.

Author's reply

No Comments.

5. Progress in Earth and Planetary Science

August 12, 2019

From: Progress in Earth and Planetary Science - Editorial Office <em@editorialmanager.com>
To: Joseph J Smulsky <jsmulsky@mail.ru>
Date: August 12, 2019, 2:56 +05:00
Subiect: Decision on your submission to Progress in Earth and Planetary Science -PEPS-D-19-00031

CC: peps_ce@jpgu.org, peps_edit@jpgu.org, editorial@progearthplanetsci.com, yasufumi.iryu.d8@tohoku.ac.jp

PEPS-D-19-00031
MAIN ACHIEVEMENTS OF THE NEW ASTRONOMICAL THEORY OF CLIMATE CHANGE
Joseph J Smulsky, doctor of physical-mathematical sciences
Progress in Earth and Planetary Science

Dear Prof. Smulsky,

Your manuscript "MAIN ACHIEVEMENTS OF THE NEW ASTRONOMICAL THEORY OF CLIMATE CHANGE" (PEPS-D-19-00031) has been assessed by our reviewers. Based on these reports, and my own assessment as Editor, I regret to inform you that your manuscript cannot be accepted for publication in Progress in Earth and Planetary Science.

Please find the reviewers' reports at the end of this email. Please also take a moment to check our website at https://www.editorialmanager.com/peps/ for any additional comments that were saved as attachments.

If at some stage you are able to fully address these concerns, you may wish to submit a revised manuscript to Progress in Earth and Planetary Science. If you are able to do this a full cover letter, explaining the revisions made, should accompany the submission.

I wish you every success with your research and hope that you will consider us again in the future.
Best wishes,
Yasufumi Iryu
Progress in Earth and Planetary Science
https://www.editorialmanager.com/peps/

Reviewer reports:

Editor's decision on PEPS-D-19-00031 J.J. Smulsky "MAIN ACHIEVEMENTS OF THE NEW ASTRONOMICAL THEORY OF CLIMATE CHANGE"

Dear Dr. Smulsky:
First of all, I am sorry for the delay of my decision. It took me sometime to confirm appropriateness of my decision. Besides, I was in a hospital for emergency surgery in July.
Anyway, based on my own assessment of the manuscript as Handling Editor as well as consultation with an expert of celestial mechanics, I regret to inform you that we decided to reject this manuscript for the following reasons.
1) Although calculation on celestial mechanics is the essential part of this manuscript, most important information such as basic equations, ways of calculation, and initial condition, are not given.
2) Many of cited references either do not exist or accessible, in unqualified journals, or in Russian. Thus, it is difficult or impossible to trace and cross check the statements and/or calculations given in the text.
3) Many of important previous works are ignored, and comparison of new results with the results of previous works are not given.
4) Nothing special about paleo-climatological implications.
5) As a result, the overall quality of the manuscript does not meet the required level of PEPS.

With best regards,

Ryuji Tada
Handling Editor and Section Chief Editor (interdisciplinary section) of PEPS

Author’s reply

From: Joseph J. Smulsky
To: Progress in Earth and Planetary Science - Editorial Office
Cc: peps_ce@jpgu.org ; peps_edit@jpgu.org ; editorial@progearthplanetsci.com ; yasufumi.iryu.d8@tohoku.ac.jp
Sent: Monday, September 23, 2019 6:32 PM
Subject: Re: Decision on your submission to Progress in Earth and Planetary Science -PEPS-D-19-00047

Dear Yasufumi Iryu, Editor,
Progress in Earth and Planetary Science,

You rejected the paper based on the reviewer's review, with a very low scientific level.

The paper shows what complex problems of contemporary science have been solved for several decades to create a new Astronomical theory of climate change. And the reviewer wants me to give the basic equations, initial conditions and a method for solving them in the paper. For this, it would be necessary to give at least 200 formulas and additional at least 20 pages of text.

The scientific level of the reviewer is so low that he does not understand this. He's also going to check the reliability of this theory. These 200 formulas will confuse him even more.

This paper is not about the evidence of the theory itself, but about its results, what they give and how to use them. At the same time, the paper shows what work was performed and what results confirming the reliability of the theory were obtained.

Unfortunately, the level of the reviewer is extremely low, and he is not able to understand even these explanations, which are understandable to anyone with a higher education.

Reviewers with such a low scientific level reject reliable papers and approve low-quality papers. Since you blindly follow the recommendations of the reviewer, your journal also has a low scientific level

I am often contacted with a proposal to take part in rating journals and Universities. Next time I'll take part and rate the journals the one they deserve.

Now many ideas about the world are based on imagined fantasies. My paper shows how our world really works. This will remain unknown to your readers.

Sincerely yours September 23, 2019 Prof. Joseph J. Smulsky

6. CLIMATIC CHANGE

April 10, 2020

From: "CLIMATIC CHANGE" <em@editorialmanager.com>
To: "Joseph Joseph Smulsky" <jsmulsky@mail.ru>
Subiect: Climatic Change: Your manuscript CLIM-D-20-00234 entitled MAIN ACHIEVEMENTS IN THE NEW ASTRONOMICAL THEORY OF CLIMATE CHANGE
Date: April 10, 2020 4:48
Climatic Change
08 Apr 2020
Ms CLIM-D-20-00234

Dear Prof. Smulsky,

Thank you for submitting your manuscript, MAIN ACHIEVEMENTS IN THE NEW ASTRONOMICAL THEORY OF CLIMATE CHANGE, to Climatic Change. As is our usual practice, our editors have evaluated carefully your manuscript before deciding whether to send it for external review.
We think that this work is more appropriate for an astronomy journal whose focus matches yours.
Accordingly, your manuscript will not be sent for external review, and we will not consider it further.

We appreciate your interest in Climatic Change and hope you will consider submitting other manuscripts to this journal in the future. For your information, please find below a link to our Editorial Policy. We wish you success in finding an appropriate outlet for your current manuscript.
Sincerely,
Michael Oppenheimer and Gary Yohe
Co-editors
Climatic Change

Climatic Change Editorial Policy: http://www.editorialmanager.com/clim/download.aspx?scheme=7&id=17

Message from Springer Nature, publisher of Climatic Change:
Although your manuscript was not suitable for Climatic Change,
Springer Nature is keen to help you find a suitable journal to publish your manuscript from our portfolio of over 2,600 journals.
One of our Submission Editorial Advisors will be in touch shortly to help you find the most relevant journal for your manuscript.

Author's reply

No Comments.

7. The European Physical Journal Plus

Author's Cover letter

24.04.2020

Dear The European Physical Journal Plus,

1. Via your submission system I have completed submission of my article: Smulsky J.J. Main Achievements in the New Astronomical Theory of Climate Change.

The Astronomical theory of climate change is based on the solution of the following three problems: (i) what are the changes experienced by the Earth's orbit? (ii) what are the changes experienced by the Earth's rotation axis? 3) what are the changes experienced by the amount of solar radiation over the Earth's latitude as dependent on the two first changes? As a result of a more precise solution of these three problems the new Astronomical theory of climate change has succeeded in explaining the factors that caused the long-term climate oscillations.

2. A month ago, I submitted this article to the journal Climatic Change. On April 10, I received the following decision of this journal:

"Dear Prof. Smulsky,

Thank you for submitting your manuscript, MAIN ACHIEVEMENTS IN THE NEW ASTRONOMICAL THEORY OF CLIMATE CHANGE, to Climatic Change. As is our usual practice, our editors have evaluated carefully your manuscript before deciding whether to send it for external review.

We think that this work is more appropriate for an astronomy journal whose focus matches yours.

Accordingly, your manuscript will not be sent for external review, and we will not consider it further.

We appreciate your interest in Climatic Change and hope you will consider submitting other manuscripts to this journal in the future. For your information, please find below a link to our Editorial Policy. We wish you success in finding an appropriate outlet for your current manuscript.

Sincerely,
Michael Oppenheimer and Gary Yohe
Co-editors
Climatic Change.

Message from Springer Nature, publisher of Climatic Change:

Although your manuscript was not suitable for Climatic Change,

Springer Nature is keen to help you find a suitable journal to publish your manuscript from our portfolio of over 2,600 journals.

One of our Submission Editorial Advisors will be in touch shortly to help you find the most relevant journal for your manuscript".

On April 14, I received a letter from Pruthvi Panchal (Editorial Submission Advisor, Springer Nature 550948:707805) recommending that the article be sent to the European Physical Journal Plus using the "Transfer Desk".

I followed this recommendation, so my article was sent to the European Physical Journal Plus.
Sincerely yours 24.04.2020 Prof. Joseph J. Smulsky

The European Physical Journal Plus

June 18, 2020

From: "The European Physical Journal Plus (EPJP)" <em@editorialmanager.com>
To: "Joseph Joseph Smulsky" <jsmulsky@mail.ru>
Subiect: EPJP: EPJP-D-20-00954
Date June 18, 2020. 18:11
Ref.: Ms. No. EPJP-D-20-00954
Title: "MAIN ACHIEVEMENTS IN THE NEW ASTRONOMICAL THEORY OF CLIMATE CHANGE
The European Physical Journal Plus
https://www.editorialmanager.com/epjp/

Dear Prof. Smulsky,

We have examined your submission and unfortunately have to inform you that we feel it to be outside the scope of our journal.
Thank you for giving us the opportunity to consider your work.
With kind regards,
Antonello Provenzale, PhD
Managing Editor
The European Physical Journal Plus

Message from Springer Nature, publisher ofThe European Physical Journal Plus:
Although your manuscript was not suitable for The European Physical Journal Plus,
Springer Nature is keen to help you find a suitable journal to publish your manuscript from our portfolio of over 2,600 journals.
One of our Submission Editorial Advisors will be in touch shortly to help you find the most relevant journal for your manuscript.

Author's reply

No Comments.

8. Scientific Reports

September 14, 2020

From: "Scientific Reports"
Sent: Monday, September 14, 2020 3:50 PM
Subject: Scientific Reports - Decision on your manuscript
Ref: Submission ID 03433a87-aa94-4cc1-a23c-f4048df7bd25

Dear Dr Smulsky,

Your manuscript entitled "Main Achievements in the New Astronomical Theory of Climate Change" has now been reviewed. Any reviewer comments on the suitability of your manuscript have been appended below. As a result, I regret to inform you that we cannot publish your manuscript in Scientific Reports.

You will see that, while your work is of interest, substantive concerns were raised that suggest that your paper does not fulfil the publication requirements for Scientific Reports that is, that papers must be technically sound in method and analysis. Unfortunately, these reservations are sufficiently important to preclude publication of this study in Scientific Reports.

Editorial Board Member comments

Dear Pr. Smulsky,

I have now received two reports commenting on your paper, entitled "Main Achievements in the New Astronomical Theory of Climate Change".

Based on my own evaluation, together with serious comments raised by the two reviewers I regret to inform you that Scientific Reports has decided not to publish your manuscript.

The two reviewers recommend the rejection because of serious issues in your model, especially the lack of a detailed comparison with previous models (which indeed are extremely different to yours), negligence of short-term astronomical observations which are fundamental for any established (constrained) astronomical model.

Reviewer #2 presented several arguments against your model, the most important one is that all previous models provided similar results suggesting moderate obliquity oscillations (Pilgrim (1904), Milankovich and Miskovitch (1941), Berger (1978), Laskar (1993), Laskar et al (2004), etc.). In particular, these previous models fit very well with high-precision, up-to-date observations, i.e. ephemerides of the Solar system, which are not tested in your model.

May be the only claim that your model is correct is stated in a concise paragraph, called as « 9.6. Final verification » dealing with geological confirmation, however, only four age points have been spelled to prove correlation with your model. Thus, I find the case made rather unconvincing, largely because the argument is not developed in anything like as much detail as it should be. In fact there is no detailed discussion of the mechanism at all, instead reference being made to a handful of papers (mainly self-citations). You should note that you propose a new astronomical theory for the paleoclimates! Geological evidence that your model is correct, with respect to other previous models, is not concretely shown or superficially discussed (reviewers #1 and #2 share the same comment). In contrast, extensive, highly resolved sedimentary records have been acquired to validate previous astronomical models!!

Another major comment is the self-citation, and your present work overlaps with your already published paper at Advances in Astrophysics, Vol. 1, No. 1, « Fundamental Principles and Results of a New Astronomic Theory of Climate Change ». This point has been raised by the two reviewers and other invited reviewers, who did not accept to report your paper, yet they provided only this note.

For your guidance, I append the reviewers' comments below.
Thank you for your interest in Scientific Reports.
Yours sincerely,
Slah Boulila
EBM
Scientific Reports

Thank you for the opportunity to consider your work. I am sorry that we cannot be more positive on this occasion and hope you will not be deterred from submitting future work to Scientific Reports.

Kind regards,
Slah Boulila
Editorial Board Member
Scientific Reports

Reviewer Comments:

Reviewer 1

General Summary:

The author shows the evolution of the Earth's obliquity over time and identifies a deviation in prediction from previous authors, namely Laskar et al. (2004). In the author's calculation, the deviation occurs over the span of ~2500 years and allows Earth's obliquity to range from ~14 – 32 deg, where all previous investigations find a much smaller range of variation (~22 - 24.5 deg.). The author attributes this difference to using a 6th order Taylor series expansion to integrate the orbital motions of the planets and the Moon, where other authors use complex numerical or semi-analytical solutions. The author compares the solutions of the rotational differential equations to two numerical methods and finds good agreement. The remainder of the paper evaluates the impact of this difference in obliquity evolution on the latitudinal flux variation on the Earth and seeks to connect the author's solution to variations in insolation at 65 deg N over the last 50,000 years.

General Comments:

The presentation within the manuscript needs to be drastically improved before publication. Much of the introduction can be removed and declarative statements need justification. The author asserts many things within the introduction that are references to the author's own work. This would not be an issue, but some of the references are in Russian which presents a substantial barrier for those who wish to verify the author's claims. The other references the author provides are used to justify the Galactica program against approximate secular calculations. However, this is inadequate because the necessary geologic evidence is not provided to perform proper hypothesis checking. If the author claims that the new results are substantially better, then this needs to be shown using geologic evidence (i.e., radioactive dating) that correlates better with the author's solution over others.

I cannot recommend this manuscript for publication due to the following reasons: 1) no additional physics is used to explain the differences between solutions, 2) the geologic chronology presented is inadequate to connect the mathematical model to a physical one, and 3) the references used in the manuscript are mainly self-citations that are somewhat difficult to obtain. The author attempts to address concern (1) by eluding to a difference in direction of a different inertial vector to either the rotational axis or the orbital axis. But, the secular theory defines the rotational axis (and thereby obliquity) relative to a vector that is normal to the planet's orbital plane. It appears that the author's deviation results from introducing an extra torque by choosing a different reference vector. Concern (2) is necessary to probe the validity of any mathematical model and an instrumental part of hypothesis testing in science. Concern (3) does not necessarily invalidate the author's work, but it does cloud other's attempts to verify the claims. The author should find additional relevant references from others in the field that obtain similar results to ease this concern.

Reviewer 2

report on : Main Achievements in the New Astronomical Theory of Climate Change
by J.J.Smulsky

By reading the title, one would think that this is a review on Astronomical Theory of Climate Change.

This is not the case. It is mainly a review of the author's work with extensive self-citation to published or unpublished papers that are far from having gained credit by the community.

The author has computed a solution for the orbital motion of the solar system, and for the rotational motion of the Earth.

Work of ephemerides of the Solar system, over short or long periods is a very special exercise as it is of no use if careful comparisons with previous works are not provided.

This is unfortunately the case of the present work.

Nothing is provided for the orbital motion, which would allow to derive any hint on the accuracy with which the integrations are performed.

These comparisons need to be done over short term, showing the maximum discrepancies with well established ephemerides as INPOP or DE, or over long term, for example by direct comparison with La2004.

But the main claim of the author is on the computation of the rotational motion of the Earth.

In this case he makes some comparisons (Fig. 5 and 6). His results for obliquity variations are 7 time larger to what has been previously found in a consistent way by many authors, starting with Pilgrim in 1904, Milankovich and Miskovitch (1941), Berger (1978), Laskar (1993), Laskar et al (2004).

The obliquity variations of the author range from 14.7 degres to 32.1 deg, compared to only 22.08 deg to 24.45 deg in the previous solutions.

The claim of the author is that this is due to the approximation by perturbation theory that is used by the other researchers.

If the author were true, this would be indeed an extraordinary result, but extraordinary results need outstanding proofs which is not the case here.

Of course, comparison of the results to observations is difficult, although some comparisons with sedimentary results could be provided. This si not the case here.

On the other hand, the orientation of the Earth has been constrained over short time (< 100 yr) by decades of precise observations, the most precise being acquired in the past 50 yrs with Laser ranging to satellites or to the Moon, and precise VLBI observations.

This has led to a reference solution for the orientation of the Earth that was indeed obtained by perturbation methods together to some complements taking into account the non rigidity of the Earth. Everything is accessible in the IERS Technical notes, the latest conventions being IERS Conventions 2010 (IERS Technical note 36), widely available at https://www.iers.org/IERS/EN/Publications/TechnicalNotes/TechnicalNotes.html.

In order to convince researchers that his model is right, and that all the celestial mechanics researchers of the past century in the field are wrong, the author needs first to show the consistency of his solution with these short time observation, and even more, that his model better fits the observations.

This is not the case in the present paper nor in the previous ones that the reviewer is aware of.

Moreover, the perturbation model has made its proofs, and it is not true that direct integration has not been used before the present work of the authors.

For example, in the case of Mars, either the perturbative model (Laskar, Icarus 2004) or the direct numerical integration (Touma and Wisdom, 1993) give the same result over a few Myr. You can compare Fig.9 from (Laskar 2004) to Fig.2 from Touma and Wisdom, 1993. We are very far from the factor 7 discrepancy found by the author of the present work.

In a similar way, complete numerical integrations of the spin of the Earth have been performed in the INPOP project (Fienga et al, A&A, 2009, Cel. Mech, 2011, 2013; Viswanathan et al., MNRAS, 2018).

This has been compared with the La2004 solution. This is not specifically published, but has been presented to the paleoclimate community in many occasions by J. Laskar. In particular at the EGU meeting in 2013, from which presentation is extracted the attached slide, where the Earth obliquity from La2004 (in green) and from INPOP (in red) are plotted over 1 Myr. There is barely any difference in the two solutions which superpose in a stunning manner.

The slide is here https://drive.google.com/file/d/1qxr7ePXLy1yDBMA1ZUjLxzK4_DjJlcmR/view?usp=drivesdk

Moreover, there is no reason to publish this paper as it is just a minor variation of the already published paper Advances in Astrophysics, Vol. 1, No. 1, Fundamental Principles and Results of a New Astronomic Theory of Climate Change by J.J. Smulsky http://www.isaacpub.org/images/PaperPDF/AdAp_100003_2016122910380825548.pdf

Our flexible approach during the COVID-19 pandemic

If you need more time at any stage of the peer-review process, please do let us know. While our systems will continue to remind you of the original timelines, we aim to be as flexible as possible during the current pandemic.

Author's reply
on Reviewers' Comments to
manuscript ID 03433a87-aa94-4cc1-a23c-f4048df7bd25
"Main Achievements in the New Astronomical Theory of Climate Change"
Reviewer 1

1. The reviewer notes that much of the Introduction can be removed.

Author. Wrong. The Introduction is very short: only three paragraphs. It gives the reader an idea of the paper content.

There is nothing in it that could be removed.

2. No additional physics is used to explain the differences between the new Astronomical theory of climate change and the previous one.

Author. Wrong. It is shown, at the beginning of the paper and in its last section (9. Proofs of the adequacy of presented results), that in the new Astronomical theory of climate change, which I developed, a new understanding of the evolutions of the Earth's orbit and its axis was obtained. It differs from the understanding in the previous Astronomical theory.

This is additional physics.

3. The presented geological chronology is inadequate for the connection of the new Astronomical theory with the paleoclimate.

Author. Wrong. In the paper I report that all geological evidence for 50 thousand years, as shown in my paper [1], confirm the new Astronomical theory and none of them confirm the previous one.

4. Smulsky refers to the proofs of the results presented in the paper to his own works, and not to the works of other authors.

Author. Right. The new Astronomical theory of climate change is based on solving 4-5 very complex problems of contemporary science. I formulated these problems, and I solved them. Therefore, I can only refer to these works of mine, where these problems have been solved.

Reviewer 2

1. There is no evidence of the reliability of the orbital motion evolution presented in the paper.

Author. Wrong. I refer to my works [2] - [9] to prove the reliability of the orbital motion evolution.

It should be noted that the paper under consideration is not about the proofs of solutions to individual problems of the new Astronomical theory of climate change, but about its results. Therefore, this reviewer's comment has nothing to do with the paper content.

2. There is no evidence of the results reliability on the Earth's rotational motion.

Author. Wrong. This evidence is given in subsection 9.3. Adequacy of the solution of the Earth's rotation problem. They are presented in more detail in [7] - [8], and the problem of the evolution of rotational motion was published in full in a recent paper [10].

3. The materials of the paper repeat the publication [7].

Author. Wrong. In paper [7] there are 16 figures, and in this one are 9, and only one figure coincides: fig. 10 with fig. 5.

In paper [7], attention is focused on the foundations of the new Astronomical theory of climate change, and in the paper under consideration - on the results. This paper is intended for a wide range of readers. The paper shows how changes occur in the orbital and rotational motion of the Earth, and how the Earth's climate changes: warm periods come in high latitudes, which are replaced by ice ages.

That is, the paper shows how our world works. In addition, the paper shows how a new understanding of the world was obtained and sources are given for those who want to get acquainted in more detail, or who will want repeat the solution of these complex problems themselves.

The second reviewer yet claims that the new Astronomical Theory of Climate Change is an outstanding achievement. In this he is really right!

But the second reviewer has doubts about his statement. He can't believe he's faced with a work that truly solves a huge problem. Mankind has been going to this solution for 200 years. As our predecessors suggested, long-term climate changes are caused by fluctuations in the parameters of the Earth's orbital and rotational motions. And these fluctuations are caused by the interactions of the Solar system bodies.

If the reviewer was a real researcher, he would have studied the materials of the paper and, based on them, would have made his own conclusion, and would not make presumptions based on what he knows.

As I already noted, this paper is about the results of the new Astronomical theory of climate change and their implications for understanding the world around us. Unfortunately, the reviewers did not pay attention to the content of the paper. They focused on defending old beliefs that had turned out to be wrong.

References

Note. In a two-number reference: 1. (21.) the first number refers to the **Author's reply**, and the second one to the paper.

1. (21.) J.J. Smulsky, New results on the Earth insolation and their correlation with the Late Pleistocene paleoclimate of West Siberia. *Russian Geology and Geophysics*, No. 57, 1099-1110, 2016. http://dx.doi.org/10.1016/j.rgg.2016.06.009.
2. (8.) J.J. Smulsky, *The Theory of Interaction*. (Publishing house: Cultural Information Bank, Ekaterinburg, 304 p., 2004) http://www.ikz.ru/~smulski/TVEnA5_2.pdf.
3. (9.) J.J. Smulsky, Galactica Software for Solving Gravitational Interaction Problems. *Applied Physics Research*, Vol. 4, No. 2. 110-123. (2012). http://dx.doi.org/10.5539/apr.v4n2p110.
4. (10.) J.J. Smulsky, The System of Free Access Galactica to Compute Interactions of N-Bodies. *I. J. Modern Education and Computer Science*, 11, p. 1-20 (2012). http://dx.doi.org/10.5815/ijmecs.2012.11.01
5. (11.) J.J. Smulsky, *Future Space Problems and Their Solutions*. (Nova Science Publishers, New York, 269 p., 2018). ISBN: 978-1-53613-739-2. http://www.ikz.ru/~smulski/Papers/InfFSPS.pdf.
6. (12.) J.J. Smulsky, The Influence of the Planets, Sun and Moon on the Evolution of the Earth's Axis. *International Journal of Astronomy and Astrophysics*, Vol. 1, Issue 3, 117-134. (2011). http://dx.doi.org/10.4236/ijaa.2011.13017.
7. (13.) J.J. Smulsky, Fundamental principles and results of a new astronomic theory of climate change. *Advances in Astrophysics*, Vol. *1*, No. 1, 1–21 (2016). http://www.isaacpub.org, http://www.isaacpub.org/Journal/AdAp.
8. (16.) J.J. Smulsky, *New Astronomical Theory of Ice Ages*. ("LAP LAMBERT Academic Publishing", Riga, Latvia,. 132 p. 2018). ISBN 978-613-9-86853-7. http://www.ikz.ru/~smulski/Papers/InfNwATLPEn.pdf. (In Russian).
9. (17.) V.P. Melnikov, J.J. Smulsky *Astronomical theory of ice ages: New approximations. Solutions and challenges.* (Novosibirsk: Academic Publishing House. 2009). http://www.ikz.ru/~smulski/Papers/AsThAnE.pdf.
10. J.J. Smulsky, The Evolution of the Earth's Rotational Movement for Millions Years. *The Complex Systems*, No. 1 (7), 3-42 (2020).

Author September 18, 2020 Prof. Joseph J. Smulsky

9. Earth

October 13, 2020

From: Valeria Sun <valeria.sun@mdpi.com>
To: Joseph J. Smulsky <JSmulsky@mail.ru>
Copy: Joseph J. Smulsky <jsmulsky@mail.ru>, Earth Editorial Office <earth@mdpi.com>, Nacy Jiang <nacy.jiang@mdpi.com>
Date: October 13, 2020, 12:07 +03:00
Subiect: [Earth] Manuscript ID: earth-973562 - Declined for Publication

Dear Professor Smulsky,

Thank you for submitting the following manuscript to Earth:
Manuscript ID: earth-973562
Type of manuscript: Article
Title: Main Achievements in the New Astronomical Theory of Climate Change
Authors: Joseph J. Smulsky *
Received: 6 October 2020
E-mails: jsmulsky@mail.ru
https://susy.mdpi.com/user/manuscripts/review_info/69d2bd9c7071af389cf41c6c9d04a7ec

We are writing to inform you that we will not be able to process your submission further. According to the latest discussion with our Editor-in-Chief, the scope of our journal is to focus on all aspects of interactions between humans and the environment, impacts, etc. However, based on the comments from our Academic Editor, your paper is a climate study and does not fit in the scope of Earth and is more suitable for Climate or Astronomy journals. We are sorry for this inconvenience and we hope you could understand.
Submissions sent for peer-review are selected on the basis of discipline, novelty and general significance, in addition to the usual criteria for publication in scholarly journals. Therefore, our decision is not necessarily a reflection of the quality of your work.
We wish you every success if you choose to submit it elsewhere.
Kind regards,
Valeria Sun
Managing Editor
/ISPRS IJGI/ Impact Factor: 2.239 (2019); 5-Year Impact Factor: 2.402 (2019);
CiteScore: 3.8 (2019) IJGI at Twitter: https://twitter.com/ISPRS_IJGI
Ms. Valeria Sun, M.Eng.
Room 2109, Jincheng Center
No. 21 Cuijingbeili
Tongzhou District, Beijing 101101, China
Skype: 1fb04ed8d2387368
Tel. 010-80556842
MDPI AG
Postfach CH-4020 Basel, Switzerland
Office: St. Alban-Anlage 66, 4052 Basel
Tel. +41 61 683 77 34 (office)
Fax +41 61 302 89 18 (office)
http://www.mdpi.com/

Author's reply

No Comments.

10. AIMS Geosciences

February 02, 2021

From: Yan Qi
To: jsmulsky@tmnsc.ru
Sent: Tuesday, February 02, 2021 2:57 PM
Subject: Decision on your manuscript Geo2020053
MS. Ref. No.Geo2020053
Title: Main achievements in the new Astronomical theory of climate change

Dear Dr. Smulsky,

We regret to inform you that our editorial committee does not recommend publication of your manuscript according to the comments from the referees.
I am sorry we are not able to bring you a positive outcome at this stage, but I hope our reviewers' comments will be helpful to you.
I am afraid that, based on the reviewers' comments and my own reading of your manuscript, we are not able to accept it for publication.
Thank you for considering this journal for publication. We are sorry to disappoint you on this occasion and wish you success in getting your work published in another journal.
Please log into our Online Editorial System to see the original comments.
For more information, please feel free to contact us.

Thank you for submitting your manuscript to AIMS Geosciences. We hope you can contribute other manuscripts to our journal in the future.
Best wishes,
Yan Qi
Editorial Assistant
AIMS Geosciences
E-mail: geosciences@aimspress.org
Website: http://aimspress.com/index.html

First reviewer's comments:

The paper presents results of decades of theoretical studies made by the author, who is a recognized scientist at the of the Siberian Branch of the Russian Academy of Sciences (http://www.ikz.ru/about/staff/smulskij-iosif-iosifovich). Among others, he published a book in Russian language (see as item [21] in the reference list).

I have found this paper as a significant contribution.

1. In this paper the author improved or fine-tuned the astronomical theory of climate change. He calls it as a "new" astronomical theory of climate change. In the paper, the Milankovitch theory is named as the "first version", the "former", the "previous" astronomical theory of climate change. His own theory is mentioned as the ?new" or ?second version". In the manuscipt under "Astronomical theory of climate change" sometimes the original, sometimes the new theory is meant. All these occurences should be systematically corrected. Instead of the present title "Main achievements in the new Astronomical theory of climate change" I would suggest "Main achievements of the fine-tuned astronomical theory of climate change".

2. "The original version of the theory was developed by M. Milankovitch [1] in the first quarter of the 20th century".

The original version of his theory was published already in 1920 and not in 1930; the finite version of the Milankovitch theory was published in 1941. On the historical aspect see Szarka et al. (2020) JASR. https://www.sciencedirect.com/science/article/pii/S0273117720306499. A few variants of the book by Milankovitch are as follows:

Milankovitch, M., 1920. Théorie mathématique des phénomenes thermiques produits par la radiation solaire. Gauthiers-Villars, Paris. In German: Mathematische Theorie der durch Sonnenstrahlung Wa¨rmepha¨nomene, Bulletin des travaux de l’Acade′mie des Sciences de Zagreb.

Milankovitch, M., 1941. Kanon der Erdbestrahlung und seine Anwendung auf das Eiszeitenproblem. Académie royale serbe. E′ditions speciales; 132 [vielm. 133]: XX, 633, Belgrade. English editions: Canon of Insolation and the Ice-Age Problem. Israel Program for Scientific Translations, Jerusalem, 1969; Zavod za Udzˇbenike i Nastavna Sredstva, Beograd/Belgrade, 1998.

3. 350 "In the previous Astronomical theory of climate change, variations of Earth’s orbital elements were received on the basis of the theory of secular perturbations."

It would be better to write "In the traditional Astronomical theory of climate change, variations of Earth’s orbital elements were received on the basis of the theory of secular perturbations."

4. There have been published papers on the short-term orbital forcing, see Cionco et al. 2017 (and Cionco et Soon 2020). You are kindly asked to explain, what is the difference between their approach and your one? It is an important question, whether Cionco et al. were correct or not, so it should be precisely discussed in the manuscript.

Cionco, R.G., Soon, W.-W.-H., 2017. Short-Term Orbital Forcing: A Quasi-Review and a Reappraisal of Realistic Boundary Conditions for Climate Modeling. Earth-Science Reviews 166, 206–222.

Cionco, R. G., Soon, W.-W.-H., Quaranta, N.E., 2020. On the calculation of latitudinal insolation gradients throughout the Holocene. Advances in Space Research 66 (3), 720–742.

Second reviewer's comments:

Dear Editor,

I found the paper by Joseph J. Smulsky could be potentially interesting, but I think that the evidence proposed are too weak.

The author essentially questions the currently accepted theory of the evolution of the orbital parameters of the Earth by mostly claiming that his improved calculations yield to an obliquity oscillation with an amplitude far greater than what it is today accepted by the scientific community. He found the obliquity to vary in the range of 14.7° to 32.1° while the currently accepted range is between 22.08° to 24.45°.

If the result were correct this would be an important discovery. However, it is not possible from the paper to check the correctness of such calculations. Thus, the paper needs to be much more explicit on the actual equations that yield to such finding.

In any case, the paper is missing important scientific validations. In other words, for example, Figure 6 shows that the new proposed obliquity curve (blue) has not only a larger amplitude but also a smaller period (perhaps about 33kyr) than the traditional one (green) which is around 41kyr. Is there any evidence that the climatic records show such a smaller period? Moreover, At page 11 it is claimed that T=-31.28 kyr was a warm epoch while T=-46.44 kyr was a cold epoch. Is there any evidence of this in the climatic records?

Without these scientific validations, and without the actual equations, it is hard to accept the author"s result.

On a minor point, Figure 5 should be better plotted. As it is, inside the figures, there are writings that overlap with the numbers.

I think that the author should try to write a more convincing paper showing stronger results.

Third reviewer's comments:

Comments for authors:

This paper has a fundamental problem, which is that the results appear to be wrong. At the top of Fig 6 the results for obliquity are compared with those due to Laskar et al (top of Fig 15 in Ref (6)) and shown to be widely different. But the latter are the results seen in textbooks, for example Fig 2.12 in:

R. A. Muller and G. J. MacDonald Ice Ages and Astronomical Causes (Springer, 2000)

These results are accepted by the cognoscenti, because they can be checked against several earlier computations obtained by completely different methods. See Figure 7(b) in:

T. R. Quinn, S. Tremaine, and M. Duncan, “A three million year integration of the Earth’s orbit” Astron. J. 101, (6), 2287-2305 (1991)

which compares closely with the top of Fig 15 in Ref (6), and also shows close agreement with earlier results due to Berger, obtained by a different method again.

I cannot therefore recommend this manuscript for publication

Author’s reply

From: Joseph J. Smulsky
To: Yan Qi
Sent: Thursday, February 04, 2021 7:07 PM
Subject: Re: Decision on your manuscript Geo2020053

Dear Yan Qi,
Editorial Assistant,
AIMS Geosciences

With the file AuthorReply.doc I am sending you my answers to the reviewer’s comments. As you will see from them, there are no flaws in the paper.

I gave detailed explanations for questions not understood by the reviewers.

The first reviewer notes that my paper is a significant contribution, and the second that it is interesting. Therefore, there is no reason to reject the paper.

Sincerely yours Prof. Joseph J. Smulsky

Author's reply to reviewers of the paper

Smulsky J.J. Main achievements in the new Astronomical theory of climate change

First Reviewer

1. The reviewer proposes to systematize the mention of the previous Astronomical theory.
I accept the proposal, and everywhere it will be referred to as "the previous theory".

The reviewer suggests replacing the word "new" with "fine-tuned" in the title. The word "fine-tuned" refers to small changes in theory that lead to better results. In this case, the changes are such that the results are completely different. If the results of the previous theory did not coincide with the change in the paleoclimate, then the results of the new theory fully coincide with the change in the paleoclimate and fully explain it.

3. The reviewer proposes to replace the word "previous" with "traditional" in one sentence.

In this case, the word "previous" is a more precise definition than "traditional".

4. The reviewer asks my opinion about the papers:

Cionco, R.G., Soon, W.-W.-H., 2017. Short-Term Orbital Forcing: A Quasi-Review and a Reappraisal of Realistic Boundary Conditions for Climate Modeling. Earth-Science Reviews 166, 206-222.

Cionco, R. G., Soon, W.-W.-H., Quaranta, N.E., 2020. On the calculation of latitudinal insolation gradients throughout the Holocene. Advances in Space Research 66 (3), 720-742.

I am familiar with these works. They consider insolation changes with periods from several years to several decades for an interval up to 13 thousand years. The astronomical theory of climate change considers insolation changes with periods of tens of thousands of years for an interval of hundreds of thousands and millions of years. Therefore, these works are not related to the Astronomical theory of climate change.

The authors of these works do not solve the problem of the evolution of the Earth's orbital and rotational motion. They use the data on these movements from the DE341-IAU ephemeris developed by JPL NASA. Ephemeris of the DE series are a mathematical approximation of observational data. They can be used outside the observational base for a time of no more than 1-2 thousand years. Therefore, NASA in a few years, starting from the 1950s, are releasing new DE series: DE102, .., DE405,: DE341, etc. I mentioned these shortcomings of ephemeris in my works [1] - [3]

Ephemeris DE341 was formally extended to 13 thousand years based on the results on the precession of the Earth's axis, which are used in the previous astronomical theory of climate change. Therefore, after 2-3 thousand years, their errors begin to increase. In addition to these errors, there are other errors in the results of Cionco and his co-authors. True short-period insolation fluctuations are available only in my works: on the interval of 100 years in [4] and 5000 years – in [5] - [6].

Since the works of Cionco and his co-authors are not relevant to my paper, it is inappropriate to mention them in it.

Second Reviewer

The reviewer notes that the obliquity changes I obtained from 14.7° to 32.1° are an important discovery.

It really is. These results were obtained by me as a result of solving an unsimplified problem of the Earth's rotation, which had not been solved before. Starting with I. Newton, for three centuries, scientists have consistently approached its solution. And I finally solved it. This solution was published in my papers [7] - [8] and monographs [5] - [6]. In Sec. 4.3 of the paper, it is mentioned. Apparently, the reviewer did not read this Section. All equations, solution methods and results can be viewed in my works. It is impossible to present them in this paper due to their huge volume.

This paper describes some of the main findings of the new Astronomical Theory of Climate Change. Even all the results cannot be given in this paper. They are all in my works mentioned in the paper.

The reviewer asks if there is confirmation of the warm epoch T = -31.28 kyr and the cold epoch T = -46.44 kyr. Of course, there is: in the paper (Sec. 4.6) it is said about this. A lot of work has been done to compare paleoclimatic data and insolation fluctuations. This work was reviewed by outstanding scientists, geologists, and paleoclimate specialists, Academician of the Russian Academy of Sciences N.L. Dobretsov and Corresponding Member. RAS M.V. Kabanov, and published [9]. All fluctuations in insolation for 50 thousand years coincide with fluctuations in paleoclimate, both in time and in amplitudes.

My works on solving problems of the orbital [3] - [10] and rotational motion of the Earth were also reviewed by outstanding scientists in celestial mechanics. They considered it necessary to publish their reviews [11] - [13].

The reviewer has a question regarding Fig. 5. Fig. 5 shows the obliquity changes for five different time intervals. For the convenience of the reader, I have shown on the graphs the periods and amplitudes of the obliquity change, which are characteristic to these intervals.

Third Reviewer

The reviewer notes that at the top of Fig 6 the new results for obliquity are compared with those due to pervious theory and shown to be widely different. Therefore, the new results are erroneous.

Apparently the reviewer did not read the paper. It is in this difference that the essence of the new Astronomical theory of climate change lies. The pervious theory with the same change in the obliquity is wrong. This is what the paper says.

References

Note: numbers in brackets, for example (9.), refer to the paper.

1. Smulsky, J.J. and Smulsky, Ya.J. (2012) Dynamic Problems of the Planets and Asteroids, and Their Discussion. *International Journal of Astronomy and Astrophysics*, Vol. 2, No. 3, pp. 129-155. doi:10.4236/ijaa.2012.23018.

2. Smulsky J.J. (2019). Angular Momentum due to Solar System Interactions. In: Gordon O. (Editor) *A Comprehensive Guide to Angular Momentum*. Nova Science Publishers, New York, p. 1-40. ISBN: 978-1-53615-707-9. http://www.ikz.ru/~smulski/Papers/CGAngMom1_2Cv.pdf.

3. (9.) Smulsky JJ (2018) *Future Space Problems and Their Solutions*. New York: Nova Science Publishers, 269 p. ISBN: 978-1-53613-739-2. http://www.ikz.ru/~smulski/Papers/InfFSPS.pdf.

4. (15.) Smulsky JJ, Krotov OI (2014) New Computing Algorithm of the Earth's Insolation. *Applied Physics Research*, No. 6(4): 56–82. http://dx.doi.org/10.5539/apr.v6n4p56.

5. (21.) Smulsky JJ (2016) *Evolution of the Earth's axis and paleoclimate for 200,000 years*. Saarbrucken, GR: LAP Lambert Academic Publishing. 228 p. ISBN 978-3-659-95633-1. http://www.ikz.ru/~smulski/Papers/InfEvEAPC02MEn.pdf. (In Russian).

6. (17.) Smulsky JJ (2018) *New Astronomical Theory of Ice Ages*. Riga, Latvia: "LAP LAMBERT Academic Publishing", 132 p. ISBN 978-613-9-86853-7. http://www.ikz.ru/~smulski/Papers/InfNwATLPEn.pdf. (In Russian).

7. (13.) Smulsky JJ (2016) Fundamental principles and results of a new astronomic theory of climate change. *Advances in Astrophysics*, Vol. *1*, No. 1: 1–21. https://dx.doi.org/10.22606/adap.2016.11001.

8. (14.) Smulsky JJ (2020) The Evolution of the Earth's Rotational Movement for Millions Years. *The Complex Systems*, No. 1 (7): 3-42.. http://www.ikz.ru/~smulski/Papers/EVDZ03_1EnJc.pdf.

9. (22.) Smulsky JJ (2016) New results on the Earth insolation and their correlation with the Late Pleistocene paleoclimate of West Siberia. *Russian Geology and Geophysics*, No. 57: 1099-1110. http://dx.doi.org/10.1016/j.rgg.2016.06.009.

10. (18.) Melnikov VP, Smulsky JJ (2009) *Astronomical theory of ice ages: New approximations. Solutions and challenges.* Novosibirsk: Academic Publishing House. http://www.ikz.ru/~smulski/Papers/AsThAnE.pdf.

11. Zelenyi LM (2019) Future problems of the space and their solutions, *Zemlya i Vselennaya (Earth and Universe)*, No. 5, pp. 103–104.

12. Cherepashchuk AM and Zharov VE (2009) Review of the *Astronomical Theory of Ice Ages: New Approximations. Solutions and Challenges* monograph by V.P. Mel'nikov and I.I. Smul'skii. *Geol. Geofiz.* Vol. 50, No. 9, p. 1072.

13. Zharov VE (2019) I.I. Smul'skii. New astronomical theory of the ice ages. *Herald of the RAS*, , vol. 89, No. 8, pp. 878–879.

11. Quaternary Research

April 19, 2021

From: "Quaternary Research" <em@editorialmanager.com>
To: "Joseph J. Smulsky" <jsmulsky@mail.ru>
Subiect: Your Submission
Date: April 19, 2021 14:03

Ms. Ref. No.: QUA-21-38
Title: Main achievements in the new Astronomical theory of climate change
Quaternary Research

Dear Dr. Smulsky--

Thank you for your submission to Quaternary Research. Your work has obvious implications for Quaternary studies, but our journal is not the right publication outlet for this level of foundational research. Our readers and editorial board members may be the ultimate users of these findings, but we are not in a position to evaluate them. I recommend you turn to the planetary and astronomical community to give your work a proper evaluation, and we will look forward to the outcome of such a process. I wish you success in moving this work forward; it obviously represents a major effort on your part.

Sincerely,
Derek Booth
Senior Editor

Author's reply

From: Joseph J. Smulsky
To: Quaternary Research
Sent: Monday, April 19, 2021 6:31 PM
Subject: Re: Your Submission

Dear Derek Booth,
Senior Editor,
Quaternary Research,

My paper is just intended for such ultimate users as the readers of your journal. In the paper I do not give a single formula. But I give a lot of astronomical knowledge so that readers can consciously and competently use the results of the paper.

The previous Astronomical Theory of Climate Change is not correct. I want the geoscientists to understand this clearly. I want them to understand why long-term climate changes occur. This will allow them to confidently use the new Astronomical Theory to correctly understand and interpret paleoclimatic evidence.

For this purpose, my paper was written.

For the planetary and astronomical community, papers are written differently. There is a lot of mathematics, mechanics and physics. Such papers and books have been written and published. References to them are available in the paper. Many reviewers and experts, including in celestial mechanics, have appreciated them. As an example, in the file RecenziaZhCrZemEn.pdf I attach a published review my book by one of these specialists (Prof. Vladimir E. Zharov, a Head of Department of Celestial Mechanics, Astrometry and Gravimetry, Lomonosov Moscow State University).

By rejecting my paper, you are condemning your readers to continue to use the wrong theory. You doom them to distort the results of their research and make them erroneous and useless. Over time, they will understand this and will be upset by the anti-scientific policy of your journal.

Sincerely yours April 19, 2021 Prof. Joseph J. Smulsky

12. Boreas

July 06, 2021

From: "Boreas" <onbehalfof@manuscriptcentral.com>
To: <JSmulsky@mail.ru>
Sent: Tuesday, July 06, 2021 9:11 PM
Subject: Boreas - Decision on Manuscript ID BOR-032-2021
06-Jul-2021

Dear Prof. Smulsky:

I write you in regards to manuscript # BOR-032-2021 entitled "MAIN ACHIEVEMENTS IN THE NEW ASTRONOMICAL THEORY OF CLIMATE CHANGE" which you submitted to Boreas.

In view of the criticisms of the reviewers found at the bottom of this letter and in the file attached (Reviewer 2), I regret to inform you that your manuscript has been denied publication in Boreas.

Thank you for considering Boreas for the publication of your research. I hope the outcome of this specific submission will not discourage you from the submission of future manuscripts.

Sincerely,

Jan A. Piotrowski, Professor
Editor-in-Chief of Boreas
Department of Geoscience
Aarhus University
Høegh-Guldbergs Gade 2
DK-8000 Aarhus C
Denmark
jan.piotrowski@geo.au.dk
Tel.: +45 8715 6409
Fax: +45 8715 0201
Skype: Jan.A.Piotrowski

Reviewers' Comments to Author:

Reviewer: 1 (Anonymous; reject)

Comments to the Author

Review report to the manuscript entitled: “MAIN ACHIEVEMENTS IN THE NEW ASTRONOMICAL THEORY OF CLIMATE CHANGE” by Joseph J. Smulsky

The manuscript introduces a new term to me: “Astronomical theory of climate change” and the very short introduction promises solutions to the following problems. 1) Changes in the Earth’s orbit, 2) Changes in the Earth’s rotation and 3) Changes in the incoming solar radiation. In the method section the author makes a large number of self-citations to 18 of his earlier papers. Many of these papers are in Russian and not even one is in a recognized international journal. Based on these citations the author claims to have calculated new solutions to the three problems that are not based on perturbations theory. The submitted manuscript thus appears as a review paper over the author’s earlier work. The author also claims that the oscillation of the obliquity range between 14.7 and 32.1 degree, much larger than the canonic value of 22.1 to 24.5.

I do therefore not think that the submitted manuscript fulfils the scientific standard of BOREAS.

In order for a paper like this to fulfil the scientific standard of BOREAS and other recognized international journals, the author would have to publish a self-explained (not based on references to his earlier work) paper in a recognized international journal that fully explained the simulations carried out, discussed any differences to other work (e.g. Laskar et al. 2004) and the possible courses of these differences.

The paper also contains several figures that have been use in some form or another in the authors earlier papers. In case the submitted manuscript is published, copy rights for these figures should be shorted out.

Reviewer: 2 (Anonymous; reject)

Comments to the Author

Last year, the referee had to review exactly the same paper that was submitted to another journal. None of the comparisons to high precision ephemerides are provided as requested by the previous report. Meanwhile, I remembered another source, with the full equations of motion for the spin axis where the authors (Quinn et al, A THREE MILLION YEAR INTEGRATION OF THE EARTH'S ORBIT, Astron. J. vol 101, 1991) found similar results as in Berger, 1978 over 1 Myr. The present work is just wrong.

If the author wants to claim the contrary, he has to compare with the high precision solutions that are directly compared to observation.

As the author did not change a word in his paper, I see no reason why I should change a word in my report in addition to what is said above.

By reading the title, one would think that this is a review on Astronomical Theory of Climate Change.

This is not the case. It is mainly a review of the author's work with extensive self-citation to published or unpublished papers that are far from having gained credit by the community.

The author has computed a solution for the orbital motion of the solar system, and for the rotational motion of the Earth.

Work of ephemerides of the Solar system, over short or long periods is a very special exercise as it is of no use if careful comparisons with previous works are not provided.

This is unfortunately the case of the present work. Nothing is provided for the orbital motion, which would allow to derive any hint on the accuracy with which the integrations are performed. These comparisons need to be done over short term, showing the maximum discrepancies with well established ephemerides as INPOP or DE, or over long term, for example by direct comparison with La2004. But the main claim of the author is on the computation of the rotational motion of the Earth.

In this case he makes some comparisons (Fig.5 and 6). His results for obliquity variations re 7 time larger to what has been previously found in a consistent way by many authors, starting with Pilgrim in 1904, Milankovich and Miskovitch (1941), Berger (1978), Laskar (1993), Laskar et al (2004).

The obliquity variations of the author range from 14.7 degrees to 32.1 deg, compared to only 22.08 deg to 24.45 deg in the previous solutions.

The claim of the author is that this is due to the approximation by perturbation theory that is used by the other researchers.

If the author were true, this would be indeed an extraordinary result, but extraordinary results need outstanding proofs which is not the case here.

Of course, comparison of the results to observations is difficult, although some comparisons with sedimentary results could be provided. This is not the case here.

On the other hand, the orientation of the Earth has been constrained over short time (< 100 yr) by decades of precise observations, the most precise being acquired in the past 50 yrs with Laser ranging to satellites or to the Moon, and precise VLBI observations.

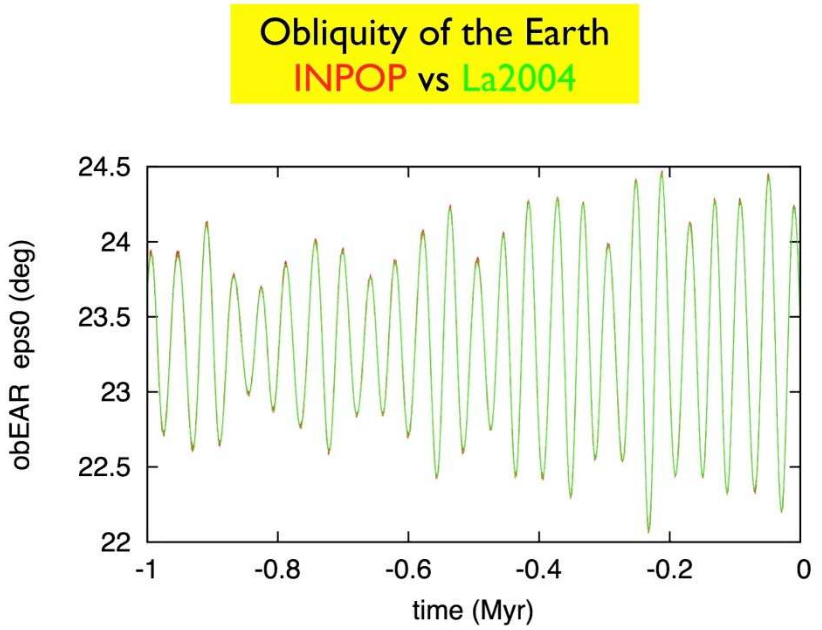
This has led to a reference solution for the orientation of the Earth that was indeed obtained by perturbation methods together to some complements taking into account the non rigidity of the Earth. Everything is accessible in the IERS Technical notes, the latest conventions being IERS Conventions 2010 (IERS Technical note 36), widely available at https://www.iers.org/IERS/EN/Publications/TechnicalNotes/TechnicalNotes.html

In order to convince researchers that his model is right, and that all the celestial mechanics researchers of the past century in the field are wrong, the author needs first to show the consistency of his solution with these short time observation, and even more, that his model better fits the observations.

This is not the case in the present paper nor in the previous ones that the reviewer is aware of.

Moreover, the perturbation model has made its proofs, and it is not true that direct integration has not been used before the present work of the authors.

For example, in the case of Mars, either the perturbative model (Laskar, Icarus 2004) or the direct numerical integration (Touma and Wisdom, 1993) give the same result over a few Myr. You can compare Fig.9 from (Laskar 2004) to Fig.2 from Touma and Wisdom, 1993. We are very far from the factor 7 discrepancy found by the author of the present work.



In a similar way, complete numerical integrations of the spin of the Earth have been performed in the INPOP project (Fienga et al, A&A, 2009, Cel. Mech, 2011, 2013; Viswanathan et al., MNRAS, 2018).
This has been compared with the La2004 solution. This is not specifically published, but has been presented to the paleoclimate community in many occasions. In particular at the EGU meeting in 2013, from which presentation I extract the attached slide, where the Earth obliquity from La2004 (in green) and from INPOP (in red) are plotted over 1 Myr. There is barely any difference in the two solutions which superpose in a stunning manner.

Author's reply

July 11, 2021

From: Joseph J. Smulsky
To: jan.piotrowski@geo.au.dk
Sent: Sunday, July 11, 2021 9:03 PM
Subject: Re: Boreas - Decision on Manuscript ID BOR-032-2021

Dear Prof. Jan A. Piotrowski,
Editor-in-Chief of Boreas,

In my paper "Main Achievements in the New Astronomical Theory of Climate Change", the main results of the new astronomical theory of climate change are presented, it is shown how they were obtained and evidence of their reliability is given. The paper also shows why the results of the previous theory are wrong. Unfortunately, the reviewers did not understand the paper due to their low scientific level. The first reviewer practically did not read the paper, and the second one looked at it superficially. For example, the second reviewer provided a graph of the obliquity change for 1 million years, which is shown in Figure 6 of the paper in the form of line *2* for the obliquity ε.

As a matter of fact, the reviewers have no judgments whatsoever. They are concerned about my references to my works, and that these works are published in Russian journals, and not published in recognized international journals.

The new astronomical theory of climate change is based on my solutions to many problems in mathematics, physics, mechanics, celestial mechanics, astronomy and other fields of science. For over 50 years I had submitted my papers to recognized international journals, but they were rejected because the problems, that I solved, refuted the hypotheses of the authors of these journals.

For 50 years, these recognized international journals have become a haven of erroneous and bogus ideas. Therefore, all modern science is defective and false.

Why is it defective and false? Because it has created an unrealistic picture of the micro- and macro-world, it does not pave the way for the further development of society and does not impede negative trends in it. Such a science is not needed by society. Society is aware of this. People refer to the discoveries of sciences as circus tricks, and in searching for a solution to the problems facing it society directs its eyes to journalists and politicians [1].

The Covid-19 epidemic has shown the helplessness of modern science. Such dangers will increasingly come upon humanity. Modern science can only exacerbate the danger, but not prevent it. Therefore, the most important task of humanity is the destruction of false science and the creation of a new science, in which there will be no dishonesty, deception and lies.

This is not an exaggeration, and you yourself will see from the attached file DaMaGrW02aJ.pdf my paper [2]. It contains the materials of 2 of my reviews of papers in the international journals "International Journal of Astronomy and Astrophysics" and "Journal of Modern Physics", in which these papers are rejected by me according to the generally accepted point of view. After these reviews, the editors of these journals invited me to join their editorial boards, and the third international journal published this paper [2]. Therefore, the generally accepted point of view, based on the Theory of Relativity and including curved space-time, the expanding Universe, the Big Bang, gravitational waves, dark matter, dark energy and many other imaginary objects of the micro- and macrocosm, is no longer a generally accepted point of view.

The publication of this paper marks a turning point in basic science. Paper [2] is a model by which reviews will be built, rejecting papers in international journals, generally recognized false ideas and hypotheses.

Yours Boreas is the twelfth journal that rejected my paper.

What needs to be done to turn recognized international journals from antiscientific ones to scientific ones?

It is necessary to publish the paper of the author, a review of it with the name of the reviewer and the author's response to the review. So did the Editor of the journal in which my paper [3] about the falsity of marine isotropic stages was published. In file IACP756.pdf, I am attaching my answer to the review [4]. It is also related to my paper “Main Achievements in the New Astronomical Theory of Climate Change”.

References

1. Smulsky J.J., (2019) *The Upcoming Tasks of Fundamental Science*. Moscow: Sputnik + Publishing House, 134 p. ISBN 978-5-9973-5228-8. (In Russian). http://www.ikz.ru/~smulski/Papers/InfPrZaFN.pdf.

2. Smulsky, J.J. (2021) Dark Matter and Gravitational Waves. *Natural Science*, 13, 76-87. doi:10.4236/ns.2021.133007. https://www.scirp.org/journal/paperinformation.aspx?paperid=107880.

3. Smulsky J.J. (2020) A New Theory of Change in the Insolation of the Earth over Millions of Years against Marine Isotope Stages. *Izvestiya, Atmospheric and Oceanic Physics*, Vol. 56, No. 7, pp. 721-747. DOI: 10.1134/S0001433820070087. https://rdcu.be/cdERE.

4. Smulsky J.J. (2020) Answers on V.M. Fedorov's comments to the article J.J. Smulsky "A new theory of change in the insolation of the Earth over millions of years against marine isotope stages". *Izvestiya, Atmospheric and Oceanic Physics*, Vol. 56, No. 7, pp. 756-758. DOI: 10.1134/S0001433820070099. https://rdcu.be/cdEHr.

Sincerely yours 11.07.2021 Prof. Joseph J. Smulsky

Boreas reply

From: "Jan Piotrowski" <jan.piotrowski@geo.au.dk>
To: "Joseph J. Smulsky" <jsmulsky@mail.ru>
Subiect: RE: Boreas - Decision on Manuscript ID BOR-032-2021
Date: July 12, 2021, 0:19

Dear Professor Smulsky

Thank you for your letter and explicit explanation of your standpoint.
I sympathize with your quest for honest science and wish you all the best in your research. You may find an outlet interested in publishing your work, in the end.
With kind regards
Jan Piotrowski

13. International Journal of Climatology

July 13 2021

Author's comment

My paper was redirected to journal using Wiley Transfer Desk.

Significant changes of the paper were required to meet the requirements of this journal, including reducing the paper long. Without meeting these requirements, the journal do not admit the paper to consideration. As soon as all the requirements were met, the journal immediately rejected the paper.

Letter of Wiley Transfer Desk

From: "International Journal of Climatology" <onbehalfof@manuscriptcentral.com>
To: <JSmulsky@mail.ru>
Subiect: Complete your submission of MAIN ACHIEVEMENTS IN THE NEW ASTRONOMICAL THEORY OF CLIMATE CHANGE to International Journal of Climatology
Date: July 13 2021 14:54

Dear Prof. Joseph Joseph Smulsky,

You're nearly finished. We have transferred your manuscript "MAIN ACHIEVEMENTS IN THE NEW ASTRONOMICAL THEORY OF CLIMATE CHANGE" to the journal you selected, International Journal of Climatology, and entered the submission details on your behalf. Now, we need you to complete the final steps of your submission.
1) Please log in to https://mc.manuscriptcentral.com/joc using your account credentials and complete your submission. (Note: If you have not previously submitted to this journal, you will have recently received an account creation email that includes your User ID and a password reset link. Follow the steps outlined in that email to activate your account and access your draft submission.)
2) Before completing the submission, you are welcome to make any changes you'd like and/or to replace the manuscript file with an updated one. We encourage you to carefully check all the transferred information and files:

If your submission at the previous journal went out for peer review, you may revise your manuscript and respond to the reviewers' comments at this stage. The peer review reports from the previous submission and your response will be made available to the Editors of International Journal of Climatology. You can upload your response letter and replace the manuscript file with an updated version (highlighting any changes) prior to completing your new submission.

You may be asked to respond to additional submission questions unique to International Journal of Climatology.

If a Cover Letter was supplied, you can also upload a new file to reflect the name of the new journal and Editor.

Please contact us at transferdeskassistant@wiley.com if you have any questions. We know how important your research is to you, and we're here to help you find the right home for it.

Kind regards,
Wiley Transfer Desk Assistant

Letter of International Journal of Climatology

15-Jul-2021

From: "International Journal of Climatology" <onbehalfof@manuscriptcentral.com>
To: <JSmulsky@mail.ru>

Subiect: JOC-21-0586 Amendments needed
Date: July 15 202111:50
15-Jul-2021

Dear Prof. Smulsky,

Thank you for submitting your manuscript, JOC-21-0586, entitled "MAIN ACHIEVEMENTS IN THE NEW ASTRONOMICAL THEORY OF CLIMATE CHANGE" to International Journal of Climatology.

Before we can commence the peer review process, would you be so kind to make some small amendments to your manuscript, in order that we can continue the review process smoothly:

*Please note that word count of the manuscript exceeds 7500 words from introduction to Acknowledgement section.

*Please insert continuous line number throughout the manuscript.

In order to facilitate this process, I have sent the submission back to your Author Centre where you will find it in Unsubmitted Manuscripts. You should then make the amendments and then reupload the submission under the same ID (rather than creating a new manuscript).

Further information on our submission guidelines can be found on our website: https://rmets.onlinelibrary.wiley.com/hub/journal/10970088/about/author-guidelines

Thank you for your collaboration.

Kind regards,
Aan
Christella Edward (Ms.)
IJOC Editorial Office

Author's reply

Dear Aan,
Christella Edward (Ms.),
IJOC Editorial Office,

I have numbered the lines of the article according to the guidelines of your journal.

This article was prepared for Boreas and transferred by Wiley Transfer Desk to your journal. It contains 9610 words, so reducing it to 7500 means it will be an other article. This article outlines an important new problem that I have been working on for several decades. This article lists only the most important results. All the reviewers who got acquainted with the article suggested that a number of other questions be stated in it, that is, they suggested increasing its long.

Therefore I have not reduced the article. If your reviewers will propose to exclude some issues from it in order to reduce the long, I will follow their advice and reduce the article.

Sincerely yours 16.07.2021 Prof. Joseph J. Smulsky

Author's comment

Since the paper was secondary declined, I rewrote the paper, reducing its length to 7500 words, and on 20-Jul-2021 sent it to the journal.

Letter of International Journal of Climatology

20-Jul-2021

To: <JSmulsky@mail.ru>
Copy: <JSmulsky@mail.ru>
Subiect: JOC-21-0586 International Journal of Climatology Confirmation of Submission
Date: July 20 202118:09
20-Jul-2021

Dear authors,

Thank you for submitting your manuscript, entitled "MAIN ACHIEVEMENTS IN THE NEW ASTRONOMICAL THEORY OF CLIMATE CHANGE", to the International Journal of Climatology. Your submission will now be checked to ensure that it adheres to journal requirements before being assigned to an Editor. If your manuscript is deemed not to meet the submission requirements you will be contacted shortly.

Should you need to contact the editorial office please ensure you use your manuscript's ID: JOC-21-0586
Thank you for submitting your manuscript to International Journal of Climatology.
Kind regards,
Christella Edward
Editorial Office
International Journal of Climatology

Letter of International Journal of Climatology

24-Jul-2021

From: "International Journal of Climatology" <onbehalfof@manuscriptcentral.com>
To: <JSmulsky@mail.ru>
Copy: <JSmulsky@mail.ru>
Subiect: International Journal of Climatology - Decision on Manuscript # JOC-21-0586
Date: July 24 202123:35
24-Jul-2021

Dear Prof. Smulsky

I write in regards to manuscript # JOC-21-0586 entitled "MAIN ACHIEVEMENTS IN THE NEW ASTRONOMICAL THEORY OF CLIMATE CHANGE" which you submitted to the International Journal of Climatology.

Unfortunately, your manuscript has been denied publication in the International Journal of Climatology on this occasion. The topic of your paper, while interesting, is out with the scope of the journal and it's readership. My suggestion would be to look to an earth sciences journal.

Thank you for considering the International Journal of Climatology for the publication of your research. I hope the outcome of this specific submission will not discourage you from submitting future manuscripts.
Sincerely,
Dr Christopher White
Deputy Editor, International Journal of Climatology

Author's comment

This is a typical example of the results of the Transfer Desk actions of all publishers. The Transfer Desk offers journals that are immediately rejected papers. This service immediately offers the following journal. And so it can continue as long as the author does not refuse the services of this Transfer Desk.

The Transfer Desk does not bear any responsibility for the fact that the paper is not suitable for the proposed journal. A meaningless service creates meaningless work for the author!