

IRSTI 06.81.23

Serik Kuzembayev¹, Gulmarzhan Tuleuova²¹Sh. Ualikhanov Kokshetau University,
Kokshetau, Kazakhstan.²S.Seifullin Kazakh Agro Technical University
Nur-Sultan, Kazakhstan.E-mail: ¹ksb_mlp@mail.ru, ²g.tuleuova@yandex.ru**Geometry in exposing false statements**

Abstract: At present, for some reason, the number of supporters of the flat Earth hypothesis is growing all over the world. In particular, in order to confirm this hypothesis a number of experiments using the most modern instruments and qualified specialists have been conducted. This paper discusses the results of these studies and analyzes the methodology of their conduct. On the basis of the dialectical approach, the invalidity of the arguments presented is shown. One of the main arguments cited to prove the plane of the Earth is the fact that the water surface is horizontal in inland waters - lakes and reservoirs. We have explained the mechanism of this phenomenon from the geometrical and hydrostatic point of view. A hypothesis has been advanced about the influence of this mechanism on the ocean expanses as well. An example of ships drifting beyond the horizon is considered. The experience of measuring geodesic curves by means of high-rise buildings is subjected to detailed analysis. The instrumental base is carefully designed and implemented. Conclusions on the results obtained do not withstand scientific criticism. The unreliability of the interpretations in the analyzed works is explained by the imperfection of the methodology of the studies performed.

Keywords: descriptive geometry, geometry, exposing, false statements, Earth plane.

DOI: <https://doi.org/10.32523/2220-685X-2022-65-2-5-15>

1. Introduction

It is well known that the word "geometry" in Greek means "measurement of the earth". This science arose from the purely practical tasks of determining the areas of land, etc. Using the laws of geometry, the Greek scientist Eratosthenes, as early as 240 B.C., established the sphericity of the Earth by the difference in the length of shadows at noon in the cities of Siena and Alexandria.

But in our time, the theory of a flat Earth has been revived and finds more and more supporters. And even in such developed countries as the United States or Germany. Even in Russia, which inherited a high level of education from the Soviet Union, about 3% of the population believe in it [1]. The Internet is full of materials proving the flatness of the Earth. However the overwhelming part of authors of works not scientists and not experts. They give unsubstantiated speculative arguments such as "The horizon is absolutely flat, and should be an arc, since the Earth is round". Most of the arguments are not scientifically substantiated and are repeated from clip to clip. They are relatively easy to refute, which many bloggers do. But unfortunately, also mostly unsubstantiated, just based on common sense.

But here a group of researchers from Brazil decided to check on the basis of detailed experiments whether the Earth is flat or not [2], and received quite convincing arguments in favor of the first statement. By now, there is an unhealthy tendency in the global community, especially among the younger generation, to believe in such fallacies. Especially when they are supported by "practical observations and scientific experiments. Ultimately, the degree of societal ignorance increases, contributing to overall degradation. All this raises serious concerns, as it can seriously affect the further development of civilization.

Therefore, in this article we will dissect and analyze the conclusions of the work [2] in favor of the "flatlanders", for which we will use geometry. After all, according to the laws of dialectics, natural and social phenomena, including science, are continuously changing, evolving and in the course of time in their development

return to their source, but at a higher level. And so geometry, beginning with the measurement of the earth, will help us in measuring the earth to prove that it is not flat.

Let's start with one of the most paradoxical phenomena: the flat surface of water in a lake. On Lake Titicaca, at a distance of 110 km from each other, an emitting laser and a receiver of its radiation were installed. The scheme of the experiment is shown in Figure 1. There is a globe O with a diameter of 12742 km . Therefore its radius $R=12742/2=6371\text{ km}$. There is a laser transmitter at point A and a receiver of laser radiation at point B . The distance between points A and B is 110 km . The instruments at points A and B are located at a height of approximately 1 m . The laser beam propagates in a straight line. If the Earth is shaped like a ball, the arc ADB can become an obstacle to the beam and the receiver B will not detect it. But for that the height of ADB must be greater than 1 m . Let us determine if it is true. Denote the length of the segment by x . Since $OD = OB = R$, $OS = R - x$. $CB = \frac{1}{2} AB = 55\text{ km}$. By Pythagoras theorem:

$$OC^2 + CB^2 = OB^2,$$

$$(R - x)^2 + 55^2 = R^2,$$

$$R^2 - 2 R x + x^2 + 55^2 = R^2,$$

$$x^2 - 2 R x + 55^2 = 0.$$

$$x_{1,2} = \frac{6371 \pm \sqrt{6371^2 - 4 \cdot 3025}}{2} = \frac{6371 \pm 6370,05}{2}.$$

Obviously, the correct answer can only be

$$x_{1,2} = \frac{6371 - 6370,05}{2} = 0,025.$$

Thus, it appears that there is a 25 meter obstacle in the path of the laser.

But the receiver picks up the laser radiation, therefore, it freely travels this distance of 110 km in a straight line AB ! Hence, the surface of the lake is flat, there is no sphericity!

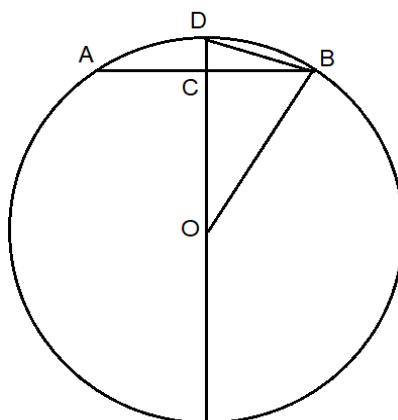


Figure 1: Schematic diagram of the experiment to check the level of the reservoir

Loza also says that the surface of Lake Baikal and any body of water in general is flat [3]. What is the essence of this paradox - a flat lake on a round Earth?

Everything can be explained by the basic law of hydrostatics - the pressure at all points inside the liquid is the same. It follows that the liquid in any communicating vessels stands at the same level.

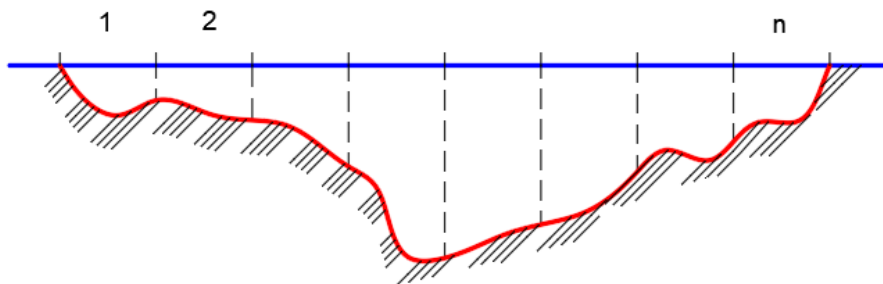


Figure 2: Profile of the lake

Let us perform a mental experiment. Take a lake and divide its entire volume into separate sections 1, 2, ..., n . All of them will be communicating vessels, and the water level will be the same regardless of the bottom profile. Indeed, let us imagine that the surface of the water in the lake corresponds to the profile of the globe (Figure 3, dashed line). Consider an arbitrary particle on the water surface. It is as if it is on an inclined plane. Then the weight of

the particle P will be decomposed by the parallelogram rule into normal N and tangential T components. And under the action of force T the particle will slide down until it comes to a state of stable equilibrium, which corresponds to a horizontal plane.

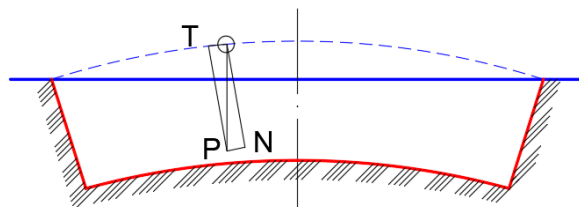


Figure 3: Real and imagined profile of the lake

Another experiment was conducted with high-frequency radio waves, again above the water surface, in a lagoon. The transmitter and the receiver were located at a height of 1 m and a distance of 14 km . The height of the curvature of the earth's surface had to be 3.84 m . Here, too, there was contact. It is explained in exactly the same way as in the first case. Another experience carried out in the considered work [1] is the disappearance of ships over the horizon. The piquancy of the situation is that this fact is usually given as a proof that the Earth has the shape of a sphere.

The essence of the experiment - the researcher visually observed the disappearance of the ship over the horizon line, and then began to look through a powerful Newtonian telescope, and again saw the ship. Again we will use Figure 1. Since nothing is said about the size of the ship in the clip, for simplicity we take the height of the above-water part of the ship to be 10 m , that is, $CD = 0.010\text{ km}$. Then in the triangle OSB the cathetus OS will be equal:

$$R - 0,005 = 6370,99\text{ км},$$

and the cathetus CB will be the unknown distance x . Again by the Pythagoras theorem:

$$x^2 = R^2 - 6370,99^2$$

$$x = \sqrt{6371,00^2 - 6370,99^2} = \sqrt{127,42} \approx 11,3.$$

It turns out that already at a distance of just over 11 km the ship will go behind the horizon line and become invisible. The analyzed experiment does not mention distances. Let's assume that since the telescope is powerful, its range exceeds 11 km, why the experimenters were able to observe the ship for some more time. They went further and even developed the theory of "reflection from water" to explain the result. In fact, this phenomenon was explained back in the last century by the influence of atmospheric refraction [4]. Its influence increases the range to the horizon. As a consequence, the calculated horizon point may not coincide with the visible one. Here again, we can see the error of the methodology.

In our opinion, the phenomenon of refraction can be supplemented by the laws of hydrostatics. But the surface area of the ocean is many times greater than that of any lake, hence its surface cannot be flat! Yes, it is curved, but its curvature is less than the curvature of the globe (Figure 4, the dotted line is the ocean surface according to the curvature of the Earth, the solid line is according to our assumption). Based on the above calculation, we can estimate it - on the order of tenths of a percent. Of course, at present it is rather problematic to verify this hypothesis. But its indirect confirmation can be the fact known to many that the visibility at sea is quite significant. Visually, the horizon line is farther away, even taking into account refraction, than it should be according to calculations.

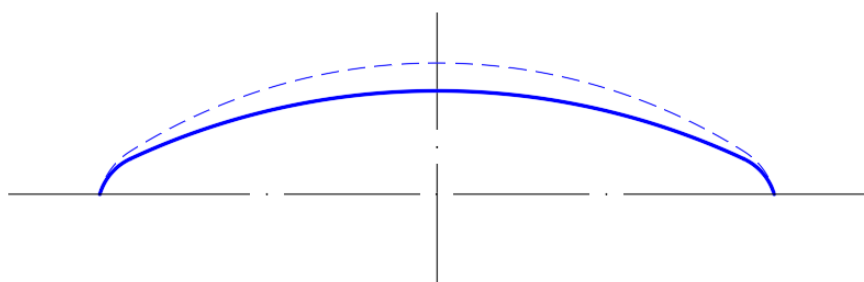


Figure 4: Assumed ocean profile

The last experiment of the researchers [2] essentially repeats the work of Eratosthenes. He considered 2 cities A and B (Figure 5), the distance between which is known, installed poles AC and BD. At noon he measured the length of the shadow B (there is no shadow

from AC at noon). According to the length of the shadow determined the angle at which the pole is directed to the Sun at zenith and thus the angle corresponding to the arc of the circle of the Earth. Based on the ratio of the lengths and angles of the arc, calculated the total length of the Earth's circumference and its radius [5].

Researchers in the considered work [2] in cities A and B at a distance of 3050 km have chosen 2 buildings of the same location and height (see figure 5). They installed gps-stations in the foundations and on the roof of the building. The task was to determine and compare the geodetic curves - distances AB and CD . Essentially, they performed the inverse task - knowing the distance between points A and B , to find the angle AOV of the divergence of the radii.

Thus the circle closed. If Eratosthenes in his study proceeded from the spherical shape of the Earth, our contemporaries tried to refute it, based on exactly the same study. This fact again shows the dialectic nature of scientific methods, repeating their cycle, but at a higher level.

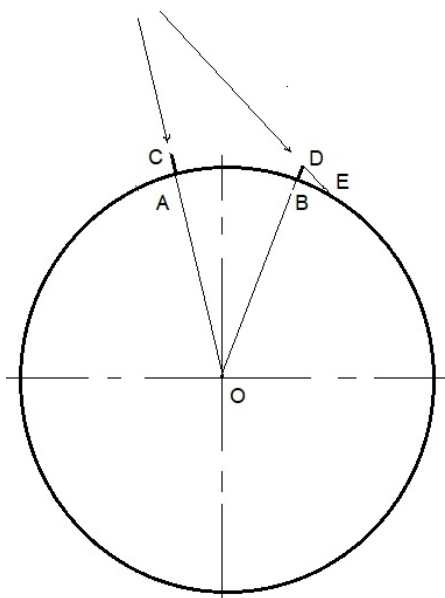


Figure 5: Diagram of Eratosthenes' measurement of the Earth's radius

At the Earth's radius of 6371 km , the arc length of 3050 km (the distance between cities A and B) corresponds to the central angle AOV , equal to 0.2743 rad . If we take the height of buildings 100 m , the corresponding new radius $OS = OD = 6371.01\text{ km}$ arc length will

be equal to 3050.080 km. This difference in distance was to be recorded by the gps sensors.

However, the results were quite unexpected - the processing of readings of devices on the foundations and on the roofs completely corresponded to each other, which refutes the hypothesis about the spherical shape of the Earth. Measurements and processing of the results were carried out by INCRA specialists. As stated in the video, it is the best company in the world in the field of topography. Consequently, there are no measurement errors and the result is reliable.

Only the repeated viewing of the video and analysis of speeches allowed to find out the truth. At the 25:15 minute mark, the INCRA representative says that they will be able to establish the perpendicularity of the building to the horizon line.

Thus, they were not determining the geodesic curves in space, but the location of the buildings relative to the horizon line. Naturally, all sensors, regardless of their elevation on the perpendicular line, will show the same coordinates of the perpendicular location. We see a very rough error in the research methodology. In fact, the methodology of processing the results is to establish the perpendicularity of the buildings to the horizon, which does not correspond to the purpose of the experiment - to determine the distance between the buildings.

Conclusion. The studies performed in the analyzed study [2] look convincing at first glance, especially the last one. The instrumental base is developed and implemented in detail. But the technique of performance of separate experiments in one way or another contains inaccuracies, which led to an erroneous interpretation of reliable results. This confirms the old truth about the fundamental role of methodology in science. The hypothesis that the Earth is a sphere is not refuted by the considered examples. We proved it from a geometrical point of view.

References

1. Poll shows how many percent of Russians think the Earth is flat / <https://russian.rt.com/nopolitics/news/539970-opros-zemlya-ploskaya>.

2. Real evidence of a flat earth. Flat Earth: history of the debate, evidence and facts / <https://valenteshop.ru/realnye-dokazatelstva-ploskoi-zemli-ploskaya-zemlya/>

3. Yuri Loza on the shape of the Earth and why he decided not to dance to the official tune / https://www.youtube.com/watch?v=NH52v8XtzaM&ab_channel=%D0%94%D0%9D%D0%9A.

4. Why people believe in a flat Earth / [electronic resource] <https://www.mirf.ru/science/ploskaya-zemlya/>

5. Earth Meter/<https://www.kommersant.ru/doc/3329946#:~:text=%D0%90%20%D1%80%D0%B0%D0%B4%D0%B8%D1%83%D1%81%20%D0%97%D0%B5%D0%BC%D0%BB%D0%B8%20%D1%83%20%D0%AD%D1%80%D0%B0%D1%82%D0%BE%D1%81%D1%84%D0%B5%D0%BD%D0%B0%20%D0%B1%D1%8B%D0%BB%D0%B0%20%D0%BF%D0%BE%D1%87%D1%82%D0%B8%20%D0%B0%D0%B1%D1%81%D0%BE%D0%BB%D1%8E%D1%82%D0%BD%D0%B0%D1%8F>.

Серік Күзембаев¹, Гүлмаржан Тулеуова²

¹Ш. Уәлиханов атындағы Көкшетау университеті,
Көкшетау, Қазақстан

²С.Сейфуллин атындағы Қазақ агротехникалық университеті
Нұр-Сұлтан, Қазақстан.

E-mail: ¹ksb_mlp@mail.ru, ²g.tuleuova@yandex.ru

Жалған мәлімдемелерді ашудағы геометрия

Аңдатпа: Қазіргі уақытта қандай да бір себептермен бүкіл әлемде жазық Жер гипотезасын қолдаушылардың саны артып келеді. Атап айтқанда, бұл гипотезаны растау үшін ең заманауи құралдар мен білікті мамандарды пайдалана отырып, бірқатар эксперименттер жүргізілді. Бұл жұмыста осы зерттеулердің нәтижелері талқыланып, оларды жүргізу әдістемесі талданады. Диалектикалық көзқарас негізінде келтірілген дәлелдердің жарамсыздығы көрсетіледі. Жер жазықтығын дәлелдеу үшін келтірілген негізгі дәлелдердің бірі –

ішкі суларда – көлдер мен су қоймаларында су бетінің көлденең орналасуы. Біз бұл құбылыстың механизмін геометриялық және гидростатикалық тұрғыдан түсіндірдік. Бұл механизмнің мұхит кеңістігіне де әсері туралы гипотеза жасалды. Кемелердің көкжиектен тыс қозғалуының мысалы қарастырылады. Көпқабатты үйлер арқылы геодезиялық қисықтарды өлшеу тәжірибесі егжей-тегжейлі талдаудан өтеді. Аспаптық база мұқият әзірленген және енгізілген. Алынған нәтижелер бойынша тұжырымдар ғылыми сынға төтеп бере алмайды. Талданатын еңбектердегі интерпретациялардың сенімсіздігі жүргізілетін зерттеулердің әдістемесінің жетілмегендігімен түсіндіріледі.

Түйін сөздер: сызба геометрия, геометрия, экспозиция, жалған мәлімдемелер, Жер жазықтығы.

Серик Кузембаев¹, Гульмаржан Тулеуова²

¹Кокшетауский университет им. Ш. Уалиханова,
Кокшетау, Казахстан

²Казахский агротехнический университет имени С.Сейфуллина
Нур-Султан, Казахстан.

E-mail: ¹ksb_mlp@mail.ru, ²g.tuleuova@yandex.ru

Геометрия в разоблачении ложных утверждений

Аннотация: В настоящее время почему-то во всем мире растет число сторонников гипотезы плоской Земли. В частности, для подтверждения этой гипотезы был проведен ряд экспериментов с использованием самых современных приборов и квалифицированных специалистов. В данной работе обсуждаются результаты этих исследований и анализируется методология их проведения. На основе диалектического подхода показана несостоятельность приведенных аргументов. Одним из основных аргументов, приводимых в доказательство плоскостности Земли, является тот факт, что водная поверхность горизонтальна во внутренних водоемах – озерах и водохранилищах. Мы объяснили механизм этого явления с геометрической и гидростатической точек зрения. Высказана

гипотеза о влиянии этого механизма и на океанские просторы. Рассмотрен пример дрейфующих за горизонт кораблей. Подробному анализу подвергается опыт измерения геодезических кривых с помощью высотных зданий. Инструментальная база тщательно разработана и реализована. Выводы по полученным результатам не выдерживают научной критики. Недостоверность интерпретаций в анализируемых работах объясняется несовершенством методологии проводимых исследований.

Ключевые слова: начертательная геометрия, геометрия, разоблачение, ложные утверждения, земная плоскость.

Использованная литература

1. Опрос показывает, сколько процентов россиян считают Землю плоской/ <https://russian.rt.com/nopolitics/news/539970> -opros-zemlya-ploskaya.
2. Реальные доказательства плоской земли. Плоская Земля: история споров, доказательства и факты / <https://valenteshop.ru/realnye-dokazatelstva-ploskoi-zemli-ploskaya-zemlya/>
3. Юрий Лоза о форме Земли и почему он решил не танцевать под официальную дудку / https://www.youtube.com/watch?v=NH52v8XtzaM&ab_channel=%D0%94%D0%9D%D0%9A .
4. Почему люди верят в плоскую Землю / [электронный ресурс] <https://www.mirf.ru/science/ploskaya-zemlya/>
5. Earth Meter/<https://www.kommersant.ru/doc/3329946#:~:text=%D0%90%20%D1%80%D0%B0%D0%B4%D0%B8%D1%83%D1%81%20%D0%97%D0%B5%D0%BC%D0%BB%D0%B8%20%D1%83%20%D0%AD%D1%80%D0%B0%D1%82%D0%BE%D1%81%D1%84%D0%B5%D0%BD%D0%B0,D0%B8%D0%B7%D0%BC%D0%B5%D1%80%D0%B5%D0%BD%D0%B8%D0%B9%20%D0%AD%D1%80%D0%B0%D1%82%D0%BE%D1%81%D1%84%D0%B5%D0%BD%D0%B0%20%D0%B1%D1%8B%D0%BB%D0%B0%20%D0%BF%D0%BE%D1%87%D1%82%D0%B8%20%D0%B0%D0%B1%D1%81%D0%BE%D0%BB%D1%8E%D1%82%D0%BD%D0%B0%D1%8F>.