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FLUCTUATION METHOD OF VERTICAL ACCOUNTING REFRACTIONS IN THE CONDITIONS OF DRY AND HOT CLIMATE OF THE REPUBLIC OF UZBEKISTAN

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ABSTRACT
The article indicates and establishes the stability of atmospheric stratification, which occurs during temperature inversion, in the early morning and late evening, when cold, denser, therefore, heavier layers of air are located below, and lighter above. At the same time, the absence and presence of thermal turbulence in the images of target targets, which makes it possible to take into account vertical refraction by the turbulent method, is shown.

KEY WORDS: Improving accuracy, local, geodesic, justification, optimal paths, solar radiation, experimental studies, heated surfaces, and the effect of refraction, surface.

INTRODUCTION
This article is the first attempt to summarize theoretical and experimental studies, mainly carried out by teachers, doctoral students and undergraduates of the department: “Geodesy and Cartography” of the Samarkand State Architectural and Construction Institute (SamGASI) in the field of atmospheric influences on astronomical and geodetic measurements.
The intensive development of modern science and geodetic production requires the improvement of methods and means of astronomical and geodetic measurements.
The central link in the program for accelerating the socio-economic development of the Republic, an approved number in the Plenums of the Cabinet of Ministers of the Republic of Uzbekistan, is a sharp increase in labor productivity [1]. The practical implementation of this program is associated with the widespread use of more advanced, productive technology and technology, with the improvement of the economic mechanism, as well as with the activation of the human factor [2].
Many areas of science, turning into a direct productive force, including geodesic science, should develop in the directions of the most complete satisfaction of the needs of the national economy.
In recent years, studies aimed at improving the accuracy of measurements have gained special importance in geodesy. Meanwhile, at the current level of geodetic instrument engineering, a further increase in the accuracy of measurements is constrained not by instrument errors, but by the inhomogeneity of the density of the atmosphere.
Due to the active action of dynamic and thermal factors, the atmosphere is an extremely mobile environment, in which movements of different nature, speed and direction are always superior. Such pulsations of meteorological elements turn the atmosphere into an environment with random inhomogeneities, which in turn cause fluctuations in the images of target targets [4-6].
The fluctuation method was first developed at the Lviv Polytechnic Institute and described in [3].
The method is based on the property of the atmosphere (despite random inhomogeneities) to always strive under the influence of gravity for stable stratification. Stable stratification occurs with temperature inversions at night, early morning, late evening, when the colder, denser and, therefore, heavier layers of air are below, and lighter above. In this case, there is no thermal turbulence, and therefore, there are no fluctuations in the images of the target targets.
With the rising of the sun, the underlying surface heats up, and from it and the lowest - surface layers of air. The inversion structure of air temperature is destroyed, adiabatic temperature gradients appear [7].

At this time, normal refraction takes place in all directions of the trigonometric network, which is determined by the formula [8].

$$\delta_{H} = 0{,}198 \frac{P}{T^2} L \qquad (1)$$

In formula (1), the length of the line L is given in meters.

However, this state of the atmosphere lasts in the middle latitudes with clear weather for 20-30 minutes, and in Central Asia, as shown by studies in [2], even less in the morning. Solar heating of the layers of air leads to the fact that its heated particles under the action of buoyant Archimedean forces rise upward with acceleration, fall into the colder layers, give them their heat and fall under the influence of gravity, trying to achieve a stable equilibrium. However, due to the buoyant action of Archimedean forces, particles for a long time manage to achieve only equilibrium stratification.

In the field of view of the pipe, the movement of air particles manifests itself as oscillations of the target.

In this case, despite the increase in amplitude, the upper peaks of the oscillating images will be at the same level, which corresponds to the equal certification of air, and the measured zenith distances will be distorted only by normal refraction. During this period, when the air particles still manage to return to the equilibrium state, the simplest version of the fluctuation method for taking into account refraction can be applied, namely, to carry out observations as usual, but not at the average position of the oscillating target, but at the upper peaks of the maximum fluctuations of this target and measured zenith distances to correct for normal refraction. Table 1 gives an example of the results of such a consideration of vertical refraction.

Table 1

Evaluation of the accuracy of determination of refraction by a turbulent method

Time h	**Anti-aircraft distance measurement**		**Refractions**			**Δ**
	Average $\mathcal{Z}_c$	**On average $\mathcal{Z}_в$**	**δ_c**	**$\delta_в$**	**$\delta_н$**	
1	**2**	**3**	**4**	**5**	**6**	**7**
On direction 4-5; S = 1300,2 m;						
$h_э = 13,6$ м; $\mathcal{Z}_T$ =89°30'38,0"						
8	89°30'35,0	89°30'33,8"	03,0"	04,2"	02,8"	1,4"
9	37,0	34,4	01,0	03,6	02,8	0,8
10	40,2	35,8	-02,2	02,2	02,7	-0,5
12	40,3	37,0	-02,3	01,0	02,6	-1,6
14	41,3	36,0	-03,3	02,0	02,6	-0,6
16	39,8	35,5	-01,8	02,5	02,5	0
18	37,4	34,5	00,6	03,5	02,6	0,9
19	37,0	33,0	01,0	03,6	02,6	1,0
20	33,0	31,1	05,0	05,9	02,7	3,2

The table below shows:

a) anti-aircraft distances, distorted by the normal and abnormal parts of refractions, when the average position of the oscillating target was observed -- $\mathcal{Z}_c$;

b) anti-aircraft distances, distorted only by normal refraction, when the upper peaks of the maximum fluctuations of the target were observed -- $\mathcal{Z}_{в}$;
c) vertical refraction in the directions - δ_c, if observations are made, as usual - on the average position of the oscillating sighting target;
d) vertical refraction in the directions - $\delta_в$, e if observations are conducted to the upper position of the oscillating sighting target.
Errors in table 1 are found by the formula (9)

$$\Delta = \mathcal{Z}_{теор.} - \mathcal{Z}_{исп} = \delta_в - \delta_н \ . \qquad (2)$$

Formula (2) is written on the basis that, as follows from the essence of the turbulent method, observations of zenith distances to the upper peaks of oscillating targets are distorted only by normal refraction.
I.e,

$$\mathcal{Z}_{исп} = \mathcal{Z}_{изм} + \delta_н \qquad (3)$$

While $\delta_в$ is equal to $\delta_н$, (of course, in the absence of other measurement errors). On condition $\delta_н = \delta_в$, $\mathcal{Z}_{исп} = \mathcal{Z}_т$. Difference between $\mathcal{Z}_{исп}$ и $\mathcal{Z}_т$ are true mistakes - Δ.

The root mean square errors due to residual refraction were calculated by the formula [2]

$$m = \sqrt{\frac{[\Delta\,\Delta]}{n}}, \qquad (4)$$

where n- number of measurements.
As a result, received m= 1,4".

Such small errors m did not always occur. With a low transmission of target rays and a large heating of the underlying surface, the temperature head from below increases and there comes a moment when the air particles can no longer return to the equilibrium (neutral) position.

With a low transmission of sighting rays and also with a large heating of the underlying surface, when the temperature pressure from below increases, there come moments when air particles can no longer return to an equilibrium position. Undercompensation occurs, therefore:

$$\delta_a = \delta_H - \Delta\delta_a \qquad (5)$$

where $\Delta\delta_a$ - abnormal part of vertical refraction "undercompensation". There is a need to experimentally investigate under what conditions "undercompensation" occurs.

In [2] there is a formula:

$$\delta_z = \delta_H - 0.05\frac{S^{\frac{1}{2}}}{h_3^w}\sigma'' \qquad (6)$$

Which, according to the authors, takes into account the component of "undercompensation."

In this formula σ'' - maximum, double amplitude of oscillations of the image of the target chain (i.e., range);h_3^w - equivalent height in degree W. Various authors [9] believe that the exponent - W can take values 1/3; 1/2; 2/3.

The question arises, what kind of exponent W can be used in the conditions of a dry, hot climate of our country. To solve this problem, the author in [6] performed experimental studies at points of class 1 triangulation networks located in the southeastern part of the Karakum desert.
Analyzing all the results obtained in this paper, we can draw the following conclusions:
The turbulent method of accounting for vertical refraction should be applied in the conditions of the Republic of Uzbekistan in directions with equivalent heights of at least 10 m. The most accurate results for determining refraction angles by the turbulent method take place if in the working formula (3) is accepted W = 2/3.

- For low directions (ath$_э$<10 м) it is necessary to stop observations for a period from 13 to 15 hours local time, when the fluctuations of the target are maximum and there is an “undercompensation" of refraction.

- In the presence of low beam directions, it is possible not to stop and observe from 13 to 15 hours, but to record refraction by pointing the horizontal line of the telescope's telescope to the upper peaks of the maximum oscillations of the target, followed by the introduction of corrections for normal refraction into the measured zenith distance . The accuracy of the method is about 3 ".

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