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About Noctilucent Clouds of the Tunguska Phenomenon

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Abstract

It is generally accepted that the Tunguska 1908 event resulted from the catastrophic disruption of a comet or an asteroid. Nevertheless there is no common agreement that the meteor really existed. In our report we argue that the concept of dominant role of noctilucent (silvery) clouds or night-luminous clouds (abbreviation: NLCs) in the mechanism of airglows of the Tunguska phenomenon is erroneous and hence cannot support the cometary/asteroidal hypothesis any further.

1. Introduction

The Tunguska event is a major mystery of the 20th century. In the early morning on June 30, 1908 a powerful explosion occurred in the Kulik-caldera, Eastern Siberia. The blast felled trees in an area nearly 2150 square kilometers. Barometric and seismic disturbances from the explosion were detected worldwide.

For the first two nights after the Tunguska explosion, skies of Eurasia were exceptionally bright and then the effect abruptly disappeared. Geographical boundaries of airglows were limited by the Yenisei River in the east, the Atlantic shore in the west, along Tashkent–Stavropol–Sevastopol–Bordeaux line in the south, and at least along Aberdeen–Stockholm line in the north (the northern border merged with the area of 'white nights' usual in the summer) [12]. Only twilight emissions with a broad diffuse spectrum like the extended twilight which usually follow volcanic eruptions have been registered.

Although most observers generally accept that some kind of a celestial body, either a comet or an asteroid, could blow up, however, the main puzzle is the absence of cosmic body remnants in/on the ground in the affected region, and now the debate about the Tunguska 1908 event continues.

2. Why the theories using NLCs of cometary origin fail?

It seems to be generally accepted that the airglows of the Tunguska event were the field of the NLCs of cometary origin [8], [11], [13]. It has been assumed that these clouds were direct result of increase in water vapors and meteoric nuclei in the atmosphere because of intrusion of a space substance of the Tunguska comet. However, there are several strong problems for any theories using NLCs of cometary origin:

(a) the NLCs may be visible from the ground (due to reflection of sunlight) only when the atmosphere at altitude of ~ 83 km is sunlit. These conditions are fulfilled when the sun is not more than 16^{o} below the observer's horizon [5]. But at night on June 30, 1908 in such cities as Tashkent the solar depression was more than 26^{o}, that is, the atmosphere was directly lit by the rays of the sun at altitude of 700 km [2], [4]. It is clear that the NLCs could not be airglows because they have been in shadow. Nevertheless in Tashkent the sky was of such brightness that photographic exposures with a normal astrograph were not possible at all [4]. Moreover, it has been proved that any optically active cometary dust particles can not remain above 100 km for a period of days [11].

(b) 'bright clouds' at characteristic heights NLCs ~ 83 km have not been noted on 30 June, 1908. So, F. Bush has defined a height of the airglow clouds over Arnsberg as equal to ~52 km [3]. T. Backhouse categorically denied a causal connection of luminescences with the NLCs and noted that the height of a bright atmospheric layers equaled ~92 km [1]. Furthermore, on June, 30th, 1908 in 12 points (London, Dublin, Bordeaux, Hamburg, Prague, Uindermir, Hirshberg, Krakow, Kherson, Hempsted, Miass, and Tiraspol) where strong luminescences were observed, the NLCs were absent all together [14];

(c) observed brightness of the sky during the Tunguska event was estimated ranging from 10^{-7} to 10^{-4} stilb [2], [11]. Usually, however, the brightness of NLCs was lower;

(d) the NLCs are so tenuous that stars shine through them almost undimmed. But in the northern sky on 30 June, 1908 only the brightest stars (e.g., Capella) were visible [11];

(e) during of the peaks of meteor showers Arietids (on June, 8th), ζ-Perseids (on June, 9th), Aquarids (on July, 28th), and Perseids (on August, 12th) a significant increase in the activity of NLCs does not occur [5]. Moreover, the peak of NLCs activity falls around July 10 when no major meteor shower exists. Above mentioned as well as other researches [6], [7], [9] indicate that the formation of NLCs is not dependent on cometary meteor showers.

It is known well that the summer months are the best time for the appearance of NLCs and hence NLCs probably were not unusual on 30 June, 1908 [10].

In our opinion, optical anomalies of the Tunguska event could have the bimodal distribution: (1) the exceptionally bright airglows on the 30 June, 1908, and (2) diminished airglows on 1 July, 1908. The NLCs could correspond to the second phase only. Even if to admit it, their origin was probable not cometary, but volcanic etc. For the first phase, i.e., on June 30, we can suppose alternatively: (a) the auroral proton event (with westward polarization electrojet) which together with the lunisolar tide triggered the explosion of Kulik-volcano; (b) the ionospheric spread phenomena as 'earthquake lights' of seismic/volcanic events [7].

3. Summary and Conclusions

We assert that the significant role of noctilucent clouds in the mechanism of anomalous airglows related to the Tunguska phenomenon is erroneous. The noctilucent clouds could not contribute considerably to the total luminosity of the sky in Eurasia on 30 June, 1908.

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