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A New Explanation of Airglows of the Tunguska Event

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Abstract

A new hypothesis for explanation of airglows of the Tunguska 1908 explosion as ionospheric spread phenomena during tectonic events is presented.

1. Introduction

On June 30, 1908 at 0:15 ± 0.05 min UT a powerful explosion occurred in the Kulik-caldera in Siberia. For the first two nights after that skies of Eurasia were exceptionally bright. At night on June 30 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 an altitude of 700 km. Nevertheless the sky was of such brightness that photographic exposures with an astrograph were not possible at all [3]. 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). Only twilight emissions with a broad diffuse spectrum like the extended twilight which usually follow volcanic eruptions have been registered. Earlier it has been proved [12] that it is impossibly to explain 'bright skies' after the Tunguska explosion by any optically active cometary dust particles because they can not remain above 100 km for a period of days.

2. Ionospheric Spread Phenomena

It was shown, days before earthquakes, even before rather weak ones, the turbulization of the plasma of ionosphere/exosphere changes [7]. There are images that clearly showed patches of turbulence associated with spread bubbles drifting across the sky [11]. During spread phenomena both the produced airglow structures, and the altitude covered with them can reach more than 1000 km [7]. For example, enhancements of light ion density have been observed in the inner plasmasphere at altitudes of 2500 km above the seismically active zone prior to the Iranian earthquake on 20 June, 1990 [1], and ionospheric variations during the Wenchuan earthquake on 12 May, 2008 extended more, than 1500 km in a latitude and 4000 km in a longitude [14]. The above parameters fit the bill to observations airglows of the Tunguska event. Furthermore, we assume that increased ionospheric conductivity could contributes to the formation of so-called 'earthquake lights'.

Ionospheric spread phenomena are caused by an enhanced activity of ULF infrasonic waves radiated by hypocentral zones closely to pre- and post-seismic periods. Prof. L. Weber reported about registrations of such daily regular oscillations with a period of 3 min at Kiel on 27-30 June, 1908 from 17:00 to 0:30 UT [13]. These pulsations were detected in the evening time only and ended on June 30 through 15 min after the explosion in Siberia. Our previous studies showed that these pulsations were caused by infrasound waves, extending from Siberia to Europe because of a preparation of earthquake in the Kulik-caldera (these waves had a correlation with a daily nightly interval of radon emission etc.; but a connection with the IMF is not excluded as well) [5]. The velocity of infrasound waves ~ 330 m/sec for a moving of seismic irregularities well explains the difference in 15 min between the time of explosion in the Kulik-caldera and the ending of the pulsations at Kiel on 30 June, 1908. Thus we have a confirmation of the spread phenomena during the Tunguska event.

In June 1908 changes of sky polarization were detected by F. Bush at Arnsberg [6]: for one day before the Tunguska explosion the polarization minima were displaced. It is known that usually polarization minima register when the sun is under horizon. It has been explained by the change in critical frequencies of ionospheric layers *E* and *F*. In turn, change of frequencies is caused by the following: at twilight an intensity of pulsations of electric vector of the geofield directed in parallel to a plane of scattering of light, reaches a night maximum earlier, than the stronger perpendicular vector. That is, the nature of depolarization can depend on changes in intensity of a geoelectric field. Thus the violate of polarization for one day before the Tunguska explosion could be evidence of changes in critical frequencies of ionospheric layers connected with changes of the geoelectric field. Probably it correlates with above mentioned spread phenomena of earthquakes as well.

Airglows of the Tunguska event for the first time were observed in Germany, Holland, Great Britain, Poland and Russia already on 22 June, 1908 [9]. They exponentially increased from 30 June to 2 July, and diminished abruptly thereafter. The brightest skyglows were observed over Belgium and West Germany (including the Aifel volcanic area) and over a Vrancea zone in Carpathians [5]). It is known that earthquakes can trigger new quakes from afar (so, the Sumatra-2004 earthquake may have weakened the San Andreas Fault [8]). Recently it is proved that the epicenter of the 1908 explosion in the Kulik-caldera is the middle of the paleo-volcanic crater associated with a mantle plume. Hence one can suppose that as a result of the displacement of the Siberian platform relative to the mantle hotspot a huge number of explosions and eruptions occurred in the Kulik-caldera as well as on the periphery of this platform on 30 June, 1908. After explosions in Siberia the first observation of a solar halo over England and the airglows over Christiania (now Oslo) occurred before noon on June 30. The dust obviously could not have originated at Kulik-caldera some 6000 km away. But a surface Rayleigh waves with a vertical component (seismo-infrasound waves) could propagate to Europe. The seismic waves both before explosion and after it have really been registered: at Bidston, Tashkent, Tiflis, Jena, Potsdam, Hamburg on 28 June; at Hamburg, Stassburg, Jena on 29 June; at Tashkent, Jena, Potsdam, Cristiania, Hamburg, Belgrad, Tiflis on 30 June; at Tiflis, Edinburgh, Potsdam, Jena, Graz, Shide, Kew, Bidston on 1 July; at Tashkent on 2 July [10]. At all these cities the airglows were observed during the Tunguska event. In addition, it was registered increase of a radon emission at Hornsea, England on 2 July, 1908 [2], as well as in Berlin, Germany in July, 1908 [4].

3. Summary and Conclusions

We suppose that seism-infrasonic waves and radon emission due to the volcanic earthquake in the Kulik-caldera in Siberia could be a cause of increase of conductivity of the atmosphere and hence of ionospheric spread phenomena, which in turn could be reasons of 'earthquake lights' observed as 'bright nights' during the Tunguska event.

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