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Earthquake precursors in atmosphere and ionosphere. A review and future prospects.

Sergey Pulinets (1,2) and Dimitar Ouzounov (3)

(1) Space Research Institute, RAS, Space Geophysics, Moscow, Russian Federation (pulse1549@gmail.com), (2) University of Warmia and Mazury in Olsztyn, Space Radio-Diagnostics Research Centre, Olsztyn, Poland, (3) Chapman University, CEESMO, Orange, California, USA, (ouzounov@chapman.edu)

The historical development in the study of physical pre-earthquake phenomena counts almost 100 years and half of this period is connected with ionospheric and thermal precursor's studies. It is 1964 M9.2 Good Friday Alaska earthquake probably was the first case when we heard on the ionospheric effects of strong earthquake. Ancient Greeks witnessed the thermal effects before earthquakes but as scientific discussion was reported only in 1983. Period from 1990 of the XX century and the first decade of XXI were the years of exponential growth of interest to the ionospheric and thermal precursors. The advances in solid earth sciences and space technologies provide a strong support in the development of different techniques of their registration and identification. Simultaneously has grown the science aimed for sound physical description and formalization of the observed anomalies. The same period for ionospheric studies was characterized with strong standing between the acoustic and electromagnetic mechanism supporters. In the science of thermal effects the first attempts to explain observed anomalies in atmosphere by greenhouse gases took place.

Latest observation from space and ground provided new evidences that the thermal and ionospheric anomalies are the branches of common complex process of environment modification having the common cause and developing in self-supporting synergetic manner exhibiting the approach to the critical point. The Lithosphere-Atmosphere-Ionosphere- Coupling (LAIC) model, created by the end of the first decade of this century clarified the problem and opened the way to the Multi-sensor-networking analysis (MSNA) and to developing the purpose directed efforts of space and ground based technologies development which are able unambiguously identify the latest stage of the seismic cycle.

We can say today, despite that we are very close to the implementation of our knowledge in practical application in the short-term earthquake forecast, still is an important challenge ahead of us to solve:

It is to find an inclusive framework between the physical precursors , which mainly is deterministic methodology and the probabilistic approach, used in seismology. The merging of both approaches in common model characterizing the last stage of the seismic cycle will probably resolve the long-standing problem of the short-term earthquake forecast, which we may expect by the end of this decade.

First draft of integrated approach will be presented.