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Thermal neutrons' response to the GLEs

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Long-term observations near the Earth's crust have shown that thermal neutrons are very sensitive regarding different processes and phenomena both in the near-Earth space and in the Earth's crust itself. The reason of it is the dual nature of the thermal neutron flux observed near the Earth's surface. Its first source is bound up with the high-energy particles of cosmic rays penetrating into the Earth's atmosphere and interacting with its elements. The second source originates from the radioactive gases contained in the Earth's crust. While the contribution of the second source is strongly depends on the Earth's crust conditions and reflects its movements, the contribution of the first space-originated source must respond to any variations of high-energy particles flux near the Earth. At the same time changes of the conditions in the near-Earth space can also result in the geodynamical processes and deformations of the Earth's crust, which in its turn will cause variations of thermal neutrons' flux. For instance, preceding experiments and analysis have statistically proved that the Earth's crossings of the sector boundaries of the Interplanetary Magnetic Field (IMF) are accompanied by thermal neutrons' variations. Ground level enhancement (GLE) recorded on January 20, 2005 by the neutron monitors world-wide network may be comparable to the greatest GLEs over the whole period of observations in spite of that it occurred at a time period close to the minimum of the 23d solar cycle. At polar stations the peak of the cosmic ray variations reached several thousands of percentages. At the same time the flux of thermal neutrons in Antarctica increased up to several hundreds of percentage. Both for the stations of neutron monitors, and thermal neutrons' monitors located at high and middle latitudes the recorded effect from this GLE was considerably less or even absent at all. The results of comparative analysis of the most significant GLEs and thermal neutrons' response to them are discussed.