The inverse problem for SEP propagation and generation in the inner Heliosphere, 2. The case of anisotropic diffusion

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It is well known that energy spectrum of solar energetic particles (SEP), observed by ground based neutron monitors and muon telescopes (in high energy region; the transfer to the space from the ground observations is made by the method of coupling functions, see in [1], Chapter 3), and by detectors on satellites and space-probes (in small energy region) changed with time very much (usually from very hard at the beginning of event to very soft at the end of event). The observed spectrum of SEP and its change with time is determined by three main parameters: energy spectrum in source, time of ejection, and propagation mode. In [2] was considered the first step for solving of inverse problem: the simple isotropic mode of SEP propagation in the interplanetary space. It was shown that on the basis of observation data at several moments of time could be solved the inverse problem and determined energy spectrum in source, time of ejection, and diffusion coefficient in dependence of energy and distance from the Sun. Here we consider the inverse problem for the second step: mode of anisotropic diffusion. We show that in this case also the inverse problem can be solved, but it needs NM data at least at several locations on the Earth. We show that in this case the solution of inverse problem starts to work well sufficiently earlier than solution for isotropic diffusion, but after 20-25 minutes both solutions give about the same results. It is important that obtained results and reality of used model can be controlled by independent data on SEP energy spectrum in other moments of time (does not used at solving of inverse problem). On the basis of obtained results can be estimate the total release energy in the SEP event and radiation environment in the inner Heliosphere during SEP event.

References:

[1]. L.I. Dorman, Cosmic Rays in the Earth's Atmosphere and Underground, Kluwer Academic Publ., Dordrecht/Boston/London, 2004.

[2]. L.I. Dorman, ‘The inverse problem for SEP propagation and generation in the inner Heliosphere, 1. The case of isotropic diffusion’. On COSPAR-2006, A-02036.