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Russian ground-level detectors of cosmic ray observations as a part of the world wide network: History and development

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Abstract

The history of creation and development of the network of cosmic ray stations in USSR-Russia goes back to the difficult years of the Second War (1944–1945). The Russian neutron monitor network continuously operates at the present time, having developed from a mechanical means of registration into a modern electronic system for the collection and processing of data with the results presented in the Internet in real time. Along with the improvement of the equipment and different methods of data processing, strong scientific groups, and even Institutes have grown up at a number of stations. They carry out scientific investigations on the basis of neutron monitor network data and provide the conditions for operative and real time exchange of data.

Keywords: Cosmic rays; Neutron monitors; World wide network

1. Introduction

Now the world network of neutron monitors totals about 50 operating stations (Shea and Smart, 2000), including 14 continuously working Russian cosmic ray (CR) stations. Fig. 1 shows the map of the distribution of CR detectors on the globe with mapped isolines of cut off rigidity, which characterize magnetically every point on Earth for incident (incoming) charged cosmic particles. The Russian stations cover an extensive area of the Earth: from 78N and 67S-polar latitudes (Barenzburg and Mirny) up to 43N (6.4 GV) – Baksan; from 14E (Barenzburg) up to 180E (Cape Shmidt-CAPS), scanning more than half the celestial sphere by longitude.

2. Historical overview

2.1. During and immediately after the Second War

The history of CR variations in Russia (more exactly, in former USSR) started officially from 11 April 1944 when, by the order N27 in NIIZM (Scientific Research Institute of Terrestrial Magnetism) the Laboratory for CR variations Research was established under the management of E.S. Glokova. The first device was a telescope on Geiger–Muller counters for recording the total ionizing CR component. This laid the start for the continual registration of cosmic rays and the study of their morphology. This Laboratory was located in Moscow in a building of the Moscow State University on Mokhovaya street. NIIZM itself remained in the Urals (Kosulino) where it has been evacuated at the beginning of the Second World War. The question of cosmic ray station creation was already being discussed in Kosulino still in October 1943, during the difficult days of the war.

The founder and the first Director of IZMIRAN (NIIZM at that time), N.V. Pushkov, was a person of rare

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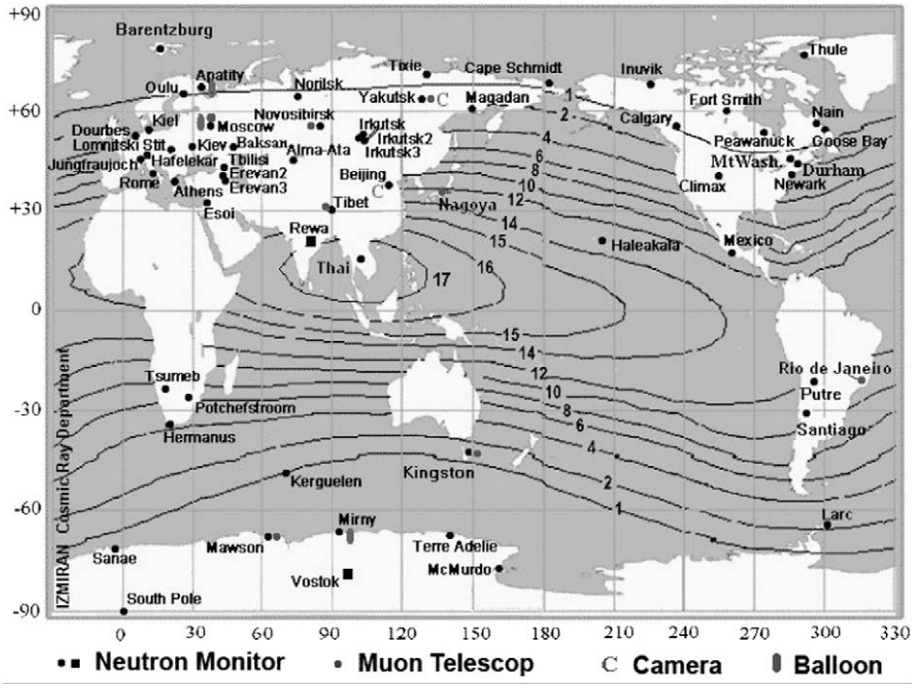

Fig. 1. Distribution of cosmic ray detectors over the globe.

erudition, he was open-minded and energetic and enthusiastic about his work. Not only did he succeed in preserving and extending the Institute in the difficult days of the war but also lead it afterwards to a high academic level. Thanks to him this Institute became known worldwide and played a leading role in important fields of research connected with terrestrial magnetism and Sun–Earth relations (Fig. 2).

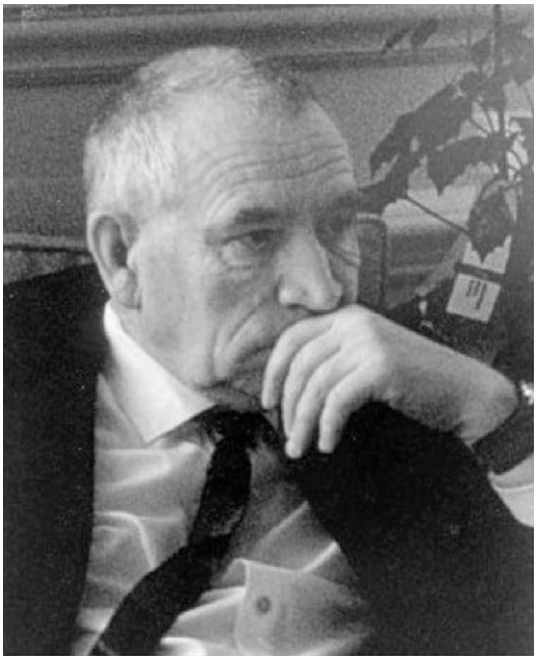

Fig. 2. N.V. Pushkov – The Founder and the first Director of IZMIRAN (NIIZM – NIZMIR-IZMIRAN). The Director of the Institute from 1940 to 1969.

Even at that time N.V. Pushkov considered that fundamental studies and complex observations of various parameters are necessary for the objective and qualitative prognosis of solar–terrestrial phenomena. When planning the new complex of magneto-ionosphere stations the list of necessary supervision included also solar and cosmic ray observations.

In 1946, under direction of E.S. Glokova, the organization of the CR station was completed. It conducted continuous observations of ionization component, and improvement available, and creation of the new equipment. The primary goal of 1946 was to manufacture counters, the transition from mechanical record to photo registration, test of all installation during registration over a long period. In July 1946 the CR detector was installed with continuous photo registration (Fig. 3).

By 1947 the problem of CR study started to attract the attention of scientists around the world. The interaction of cosmic rays with the Earth's atmosphere was proved and a relation with geomagnetic phenomena was found. This encouraged NIIZM to extend work in the CR study area. Along with research activity in NIIZM it became necessary to organize new stations of cosmic rays in different points of USSR at different latitudes (Moscow, Yakutsk, Yerevan, Tashkent, Ordjonikidse). Besides NIIZM nobody in USSR was directly engaged at that time in the question of studying CR, and consequently NIIZM became the supervising and coordinating center in the development of a network and research of CR variations.

Yu. Shafer, together with professor MSU Vernov S.N., designed a device for continuous registration of CR (the first ionization chambers of small volume – 20 L) which