

Name of research institute or organization:

Physikalisches Institut, Universität Bern

Title of project:

Neutron Monitors - Study of solar and galactic cosmic rays

Project leader and team:

Prof. E.O. Flückiger, project leader
Dr. R. Bütikofer

Project description:

Despite their decades of tradition neutron monitors (NMs) remain the state-of-the-art instrumentation for measuring GeV cosmic rays that cannot be measured in the same simple, inexpensive, and statistically accurate way by space experiments. By continuously monitoring the cosmic ray intensity near Earth in a worldwide network since the International Geophysical Year 1957/58, they have been providing key information about the interactions of the galactic cosmic radiation with the plasmas and magnetic fields in the heliosphere, and about the production of energetic cosmic rays at the Sun.

At Jungfraujoch we are operating an IGY neutron monitor (installed in 1958) and a NM64 neutron monitor (installed in 1985). These NMs, located at mountain altitude for improved response, fill the latitude gap between the stations in Rome and Dourbes. Thus, the NMs of Western Europe (Oulu, Turku, Kiel, Dourbes, Jungfraujoch, and Rome) are well distributed in latitude for measuring the rigidity dependence of the intensity/time variations of the primary cosmic radiation in the rigidity range from ~1.5 GV to ~6.5 GV.

The records of the two NMs at Jungfraujoch are published in the form of data books, of special reports, and on a webpage (<http://kspc4.unibe.ch/nm>). The relative count rate of the IGY NM for 2001 is shown in Figure 1. The high variability of the data reflects the maximum phase of sunspot activity cycle 23. The worldwide network of NMs recorded four ground level enhancements (GLEs), i.e. short-time cosmic ray intensity increases due to the arrival of relativistic solar particles: GLE#60 on April 15, GLE#61 on April 18, GLE#62 on November 4, and GLE#63 on December 26. Only on April 15 were solar particles with rigidities above the Jungfraujoch geomagnetic cutoff rigidity of 4.63 GV present, causing a NM count rate increase of ~7% in the 5-minute data as illustrated in Figure 2 (see also our report in this volume on the SONTEL measurements at Gornergrat). In association with the passage of interplanetary shocks several significant global decreases in the cosmic ray intensity (Forbush decreases) were recorded, the largest of them on April 11/12, with an amplitude of more than 10% in the hourly data. Analysis of these events has been initiated worldwide.

As in previous years, we organized a training course for the “Institut Français pour la Recherche et la Technologie Polaires (IFRTP)” for technicians assigned to be responsible for the French NMs at Kerguelen and Terre Adélie during one year. Four technicians were trained at Jungfraujoch in the operation and maintenance of these detectors from October 23-25, 2001.

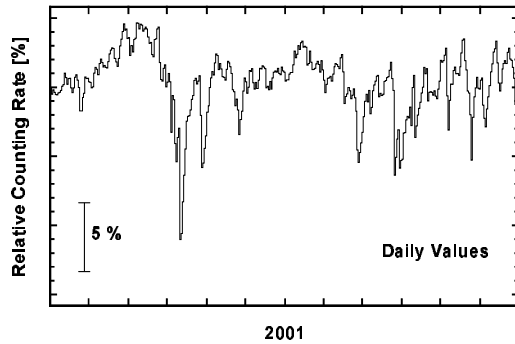


Figure 1: Pressure corrected relative daily counting rate of the IGY neutron monitor at Jungfraujoch for 2001.

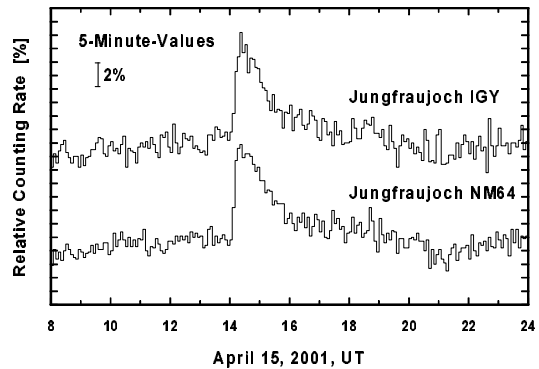


Figure 2: The relativistic solar particle event of April 15, 2001, as recorded by the neutron monitors at Jungfraujoch (relative 5-minute counting rate).

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Key words

Astrophysics, cosmic rays, neutron monitors; solar, heliospheric and magnetospheric phenomena

Collaborating partners/networks:

International Council of the Scientific Union's (ICSU) Scientific Committee on Solar-Terrestrial Physics (SCOSTEP)

World Data Centers A (Boulder), B (Moscow), C (Japan), International GLE database

Scientific publications and public outreach 2001:

Bieber, J.W., E. Eroshenko, P. Evenson, E.O. Flückiger, and R. Kallenbach (editors), *Cosmic Rays and Earth*, Space Science Series of ISSI, **10**, Kluwer, 2000. (ISBN 0-7923-6712-X)

Belov, A.V., R. Bütikofer, E.A. Eroshenko, E.O. Flückiger, and V.G. Yanke; Analysis of the July 14, 2000, GLE; Proc. 27th International Cosmic Ray Conference **8**, 3362, 2001

Data Reports: Data of the 18IGY-Neutron Monitor Jungfraujoch, 01.01. - 30.06.2001
Data of the 18IGY-Neutron Monitor Jungfraujoch, 01.07. - 31.12.2001
Data of the 3NM64 Neutron Monitor Jungfraujoch, 01.01. - 30.06.2001
Data of the 3NM64 Neutron Monitor Jungfraujoch, 01.07. - 31.12.2001
Neutron Monitor Data for Jungfraujoch and Bern During the Ground-Level Solar Cosmic Ray Event on 15 April 2001

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