



Number 164, December 2005

COSPAR'S INFORMATION BULLETIN

SPACE RESEARCH TODAY

Cosmic Vision

Space Science for Europe 2015-2025



Conference on Solar Extreme Events: Fundamental Science and Applied Aspects (SEE-2005)

[Report by Ashot Chilingarian]

During the week of 26-30 September 2005, 75 scientists and students from 11 countries attended the second conference on Solar Extreme Events (SEE-2005) at Nor Amberd, Armenia.

Investigation of the Solar Extreme Events is important for several reasons:

- It provides unique information about violent processes in the solar corona, including the mechanisms of particle acceleration and Coronal Mass Ejection (CME);
- The study of the propagation of huge amounts of solar plasma in the interplanetary space can shed light on the interactions with the Interplanetary Magnetic Field (IMF) and ambient population of the Galactic Cosmic Rays (GCR);
- Interplanetary shocks and CMEs, along with solar particle and electromagnetic emissions, trigger various dynamic processes in the Earth's magnetosphere, causing global geo-effective effects, including for example geomagnetic storms, heating of the upper atmosphere, changes in the electrodynamic properties of the ionosphere, and creation of geomagnetically-induced surface currents. All these constitute conditions of Space Weather (SW) that change dramatically with SEE development.
- Space Weather can influence the performance and reliability of space-borne and ground-based technology systems and can endanger human health and life. It is of major importance to establish accurate methods for monitoring and forecasting the strength of SW disturbances and to identify the mechanisms of the various SW effects.

The solar extreme events of October-November 2003, known as the Halloween events, have provided us with rich information to study and reach a better understanding of space weather. The SEE symposium in Moscow in July 2004 focused on comprehensive discussions of solar/heliospheric and magnetospheric aspects of these events. The data obtained onboard numerous satellites and from ground-based observatories were presented, discussed and interpreted both from experimental and theoretical points of view. Meetings during the COSPAR Assembly (Paris, July 2004) and the European Cosmic Ray Symposium (Florence, September 2004) also demonstrated the community's substantial interest in and the continuing efforts to understand in detail the 2003 Halloween events. New attempts to develop analytical techniques to incorporate data from space-borne and surface instruments have opened new perspectives in the understanding and forecasting of the consequences of SEEs.

In 2004 several extreme events from the end of July to mid-November provided new examples of the severe Geospace Storms and Forbush decreases. The 23rd solar cycle reserved its most severe events for the descending phase. The largest in nearly half a century, Ground Level Enhancement (GLE) from the 20 January 2005 event caused gigantic count rate increases on the south polar neutron monitors. The event demonstrated very complicated behaviour, revealing a diversity of particle acceleration mechanisms and the importance of the numerous factors influencing particle transport, composition and event geo-effectiveness. Analysis of these events is under way and will provide extremely interesting basis for the understanding of SEEs and their effects.

The aims of SEE-05 were twofold:

- (1) To provide a wide forum for discussion of recent Solar Extreme Events and their impact on technological systems and human environment, and
- (2) To discuss directions for future research,

while promoting cooperation between groups with different research interests from different countries.

The scientific programme was divided into three major areas:

- Energetic processes on the Sun during extreme events
- The magnetospheric response to the solar extreme events
- Violent conditions of space weather and the possibilities for forecasting

Sessions consisted of invited talks and contributed papers presented in poster session. High-quality invited talks were given by Vahe Petrossian, Igor Veselovsky, Riho Nymmik, Vladimir Kuznetsov, Galina Bazilevskaya, Leonid Lazutin, Yuri Stozhkov, Yuri Yermolaev, Erwin Flueckiger, John Bieber, Anatoly Belov, Michail Panasyuk, Frank Jansen, Yasushi Muraki. The review talks highlighted how the Sun affects the heliosphere and the Earth's environment with particular emphasis on energetic particle storms, the solar eruptions that produce them, and the impact of these on the Earth.

Conference reports demonstrated that integrated information on the consequences of Extreme GLEs and Super Storms, including the spectral forms, amplitudes and anisotropies of ion fluxes in vicinity of Earth, ICME parameters and the state of the magnetosphere are valuable for testing solar ion acceleration and propagation models as well as for early diagnostics of the expected technology impact of violent solar eruptions.

New types of particle monitors, measuring as much as possible of secondary cosmic ray fluxes with inherent correlations are necessary for establishing world-wide networks for Space Weather forecasting. The International Heliophysical Year should provide good opportunities for establishing these networks, and involve participation by developing countries and, of course, European Space Weather initiatives.

The conference site was located near experimental facilities of the Aragats Space – Environmental Center (ASEC). Operation of ASEC monitors was demonstrated to conference participants; in addition, the data base of solar extreme events as detected by ASEC monitors was available in a computer class. Prototype detectors, developed by the Cosmic Ray Division of Alikhanyan Physics Institute (the conference host) which are planned to be used for the new Space Weather network, were demonstrated during the poster sessions. Participants from Croatia, Bulgaria and Costa Rica expressed interest in being the part of the new network by installing detectors on their sites. Negotiations concerning the format of such cooperation are underway.

The conference was supported by COSPAR, the International Science and Technology Center, National Foundation of Science and Advanced Technologies and WEB limited.

It is planned to publish the conference proceedings. For more information, for the book of conference abstracts and for slides of the invited talks see: <http://crdx5.yerphi.am/>