Space Weather Research for Developing countries

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The space-born technologies have rapidly become one of largest segments of the world industry, providing critical infrastructure that support the quality of life on Earth. Because of humanity's increasing dependence on space-based systems, spacecraft that can survive and operate through all space environment conditions are required. It is not possible to achieve cost-effective, "all weather" space systems without accurate knowledge of the Space Weather. Space Storms lead to loss of data, degradation of capability, service outages, and, in extreme cases, the loss of satellite. Space Weather can affect satellites:

- For semiconductor microelectronics, the electric charge induced when a heavy ion passes through the part, or when particle has a nuclear interaction in the part, is often comparable with the spurious charge moving in device circuits. Thus, the device's state can be changed. This can result in various types of transient or permanent single event effects (SEE) such as upset, latchup or burnout of the device.
- Space weather can raise temperatures in the outer reaches of the atmosphere, causing the atmosphere to expand, snatch satellites from orbit by increasing drag.
- The other main danger to satellites is charging and electrical shorts caused by the magnetic activity and accelerated particles.

Space weather can affect everyday lives:

- Solar events occur at a magnitude of violent force and energy that equals the power of a billion hydrogen bombs, fortunately people on the ground are not at risk from solar storms, protected by the magnetosphere and atmosphere, but…
- space Storm Causes Power Outages, a power grid in Canada was tripped by a 1989 storm, and electricity to the entire province of Quebec was lost for about 9 hours;
- airline passenger can experience as much radiation as 10 chest X-rays elevated doses of radiation can be experienced on high-altitude flights, caused airlines to reroute commercial flights;
- radio communications were disrupted, at least two key U.S. communications satellites were disabled by solar weather in the late 1990s, causing failures in personal pagers, television broadcast and some airline traffic communications;
- increase the probability of latent cancer formation in the astronaut/space traveler cohort.

If alerted the satellite operators can perform simple preventive actions to reduce the damage:

- Satellite operators put satellites to sleep. They rotated some so vulnerable solar panels were better protected, and made arrangements to switch signals to backup satellites if necessary;
- elevated doses of radiation can be experienced on high-altitude flights, caused airlines to reroute commercial flights
- Astronauts should retreat to the well-protected module.

Forecasting systems comprises from the space-born spectrometers and coronagraphs, the surface based systems detection radio-bursts and variations of cosmic rays are also vital part of the global monitoring of space weather:

- Put a satellite closer to the Sun to predict a space storm's magnetic field earlier, but…
- Some instruments aboard SOHO were shut down during powerful flares to prevent damage. Others are operating at reduced capacity;
- Some devices produce less-than-perfect images because they get covered with "snow" that represents the charged particles streaming out from the Sun;
- Most energetic particles detected by surface monitors bring information about upcoming storms 10 hours prior shock arrival.

Aragats Space Environmental Center (ASEC) monitors operate on the slope of mountain Aragats in Armenia as a part of Cosmic Ray Division (CRD) of Alikhanyan Physics Institute. ASEC is one of world-biggest centers for continuous monitoring of the changing fluxes of cosmic rays. The research program of ASEC includes:

- Measurement as much as possible secondary CR fluxes with different energy thresholds;
- Monitoring not only changing count rates, but also correlations between changing CR fluxes;
- Measurement directional information;
- Use same detectors for both SW and high energy CR studies;
- Simulation of the time-series registered by the ASEC monitors;
- Correlation surface and space-born detectors data assessable from the Internet;
- Issuing of forecasting and alerts on severe conditions of the Space Weather.

The developing countries should also find their ways to participate in this crucially important endeavor, because:

- Most of technical progress in 21 century will come from Space Operations;
- New Space vision has Space Weather research and forecasting as a vital element for Space Operations;
- Information from networks of surface based detectors measuring secondary cosmic rays are compatible to data from space-born particle detectors and can be used for the reliable and timely SW forecasting;

- Developing countries should be a part of such networks to participate in the exploration of the Solar System and Universe;
- Necessary equipment is rather cheap and can be installed in scientific and educational institutions, schools, to make Space Research and Physics interesting and important for new generations.

The Space Weather detectors of new generation now under construction in CRD can serve as a good basis for the implementation of the regional scientific and forecasting network including Armenia, Georgia, Azerbaijan, Iran, Turkey, Emirates, Dubai and other countries. Installation and networking expenses will not exceed $50,000 and will permit the developing countries produce data vitally necessary for the space operations, those making links to the science and technology of 21st century.