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Spaceship Earth: A Neutron Monitor Network Optimized for Solar Cosmic Rays

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Owing to the large detector mass required to detect high-energy cosmic rays, ground-based instruments remain the state-of-the-art method for studying these elusive particles. Neutron monitors record the byproducts of nuclear interactions of high-energy primary cosmic rays with Earth's atmosphere. At a rate of roughly 10 per solar cycle, the Sun emits cosmic rays with sufficient energy and intensity to increase radiation levels at Earth's surface, resulting in a "Ground Level Enhancement" (GLE).

Spaceship Earth is a multi-national network of 11 neutron monitors on 4 continents optimized to measure the angular distribution and time evolution of solar cosmic rays. It began operation in 2000, in time to provide key observations of several of the major GLE of Solar Cycle 23, including one that featured the largest enhancement of cosmic radiation at sea level in nearly half a century (Figure 1). This talk will highlight the insights gained from analyses of these remarkable events.

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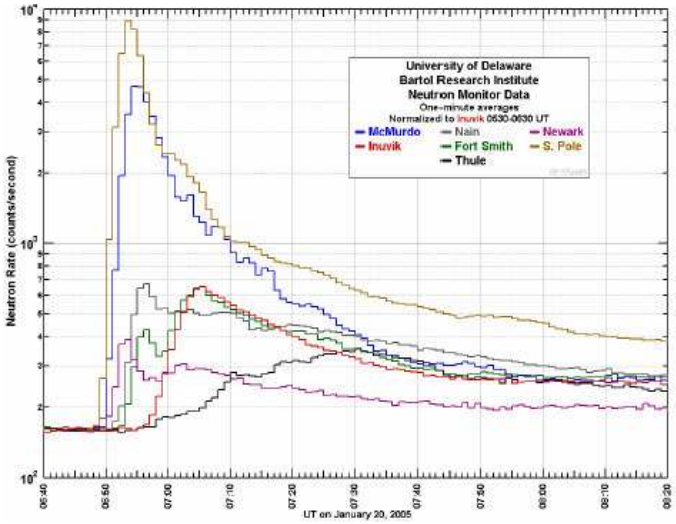

Figure 1. On January 20, 2005 the Sun emitted cosmic rays of sufficient energy and intensity to increase radiation levels on Earth's surface. The GLE was especially intense at South Pole (highest peak) and McMurdo, Antarctica (second highest), where radiation levels increased by factors of 56 and 30, respectively, in a span of 5 minutes. The McMurdo increase was the largest observed at sea level since 1956.