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Neutron Monitor Research in Thailand

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A neutron monitor (NM) detects atmospheric secondary particles, mostly neutrons, due to cosmic rays, i.e., energetic particles from space. The main goal of an NM is to track time variations in the cosmic ray flux to high precision, over time scales from minutes to decades. These time variations are due to effects of the solar wind and solar storms, both of which vary with the 11-year sunspot cycle and/or the 22-year solar magnetic cycle. This talk summarizes NM research in Thailand, including the establishment of the Princess Sirindhorn Neutron Monitor (PSNM) at the summit of Doi Inthanon, and analysis of data from PSNM and other NMs worldwide. We have explained trains of enhanced daily variation at PSNM in terms of the cosmic ray anisotropy associated with high-speed solar wind streams. We analyzed data from a ship-borne NM operated by a US-Australian collaboration during 1994-2007, and confirmed a change in the cosmic ray spectrum due to a solar magnetic polarity reversal. We have developed Monte Carlo simulations of cosmic ray showers in the atmosphere and secondary particle interactions in an NM. Using a portable calibration NM from South Africa, we measured the effects of the PSNM building on the calibrator count rate and explained them in terms of Monte Carlo results. We also developed a new capability for a single NM station (PSNM) to track short-term variations in the cosmic ray spectrum, not only the cosmic ray flux, and show data on different spectral responses to different solar storms. Finally, we discuss our modeling of data from polar NMs to determine the emission of relativistic solar particles from the giant solar storm of 2005 Jan 20, which enhanced Earth' s radiation environment by 50 times in some locations, and we discuss the effects of major solar storms on human economic activity.

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