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Heliospheric modulation of cosmic rays throughout the last 50 years

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The energy spectrum of galactic cosmic rays at 1 AU is a subject to the heliospheric modulation. We have performed detailed calculations of the response of a neutron monitor to the modulated galactic cosmic ray flux ($\alpha-$particles have been also included). It is shown that the contribution of the energetic cosmic rays (above 100 Gev/nucleon) is essential in the neutron monitor count rate, especially for mid- and low-latitude stations. Although the detailed mechanisms affecting the modulation are complicated and studied elsewhere, the shape of the modulated spectrum can be nearly perfectly parameterized with a single formal modulation parameter, the so-called modulation potential, in a wide range of the modulation strength (excluding Forbush-decreases and solar proton events). This is discussed using a variety of balloon- and space-borne direct measurements of the cosmic ray spectrum. Using the above mentioned calculations and the archive of world-wide neutron monitor count rates, we have computed, by means of least square fit, the modulation parameter with monthly resolution for the period since 1951. A good agreement between the neutron monitor-based modulation parameter and fragmentary direct measurements of the cosmic ray energy spectrum is found. We also discuss possible applications, uncertainties and limitations of these results.