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The heliolongitudinal dependence of solar wind velocity and the 27-day variation of cosmic rays

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We study relationship of the first (27 days), second (14 days) and third (9 days) harmonic waves of the 27-day variation of the galactic cosmic ray intensity with the similar changes of solar wind speed and the interplanetary magnetic field based on the experimental data. We develop a three dimensional model of the 27-day variation of cosmic rays with the heliolongitudinal variation of solar wind speed. To keep self-consistency, divergence-free interplanetary magnetic field is derived by solving the Maxwell equations with a spatial variation of solar wind speed, reproducing in situ measurements. We perform model calculations for cosmic rays using the variable solar wind speed and the corresponding magnetic field. Results are compatible with neutron monitors observations. On the basis of the convection-diffusion modulation model the expected cosmic ray profiles of the first (27 days), second (14 days) and third (9 days) harmonic waves of the 27-day variation of cosmic rays are inversely correlated with the modulation parameter ζ being proportional to the product of the corresponding solar wind velocity V and the strength of the interplanetary magnetic field B ($\zeta \sim$ VB). High anticorrelation between them shows that the predictable cosmic ray profiles are mainly due to this basic modulation effect.